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New York (State) Natural history survey

STATE OF NEW-YORK.

No. 275.

IN ASSEMBLY,

February 27, 1839.

COMMUNICATION

From the Governor, relative to the Geological Survey of the State.

Albany, *February* 23, 1839.

TO THE ASSEMBLY.

By an act of the Legislature, passed on the 15th of April, 1836, the Governor was authorized and directed to employ a suitable number of competent persons, whose duty it should be under his direction to make an accurate and complete geological survey of this State; which survey should be accompanied with proper maps and diagrams, and furnish a full and scientific description of the rocks, soils and minerals of the State, and of its botanical and zoological productions, together with specimens of the same. It was further provided, that such maps, diagrams and specimens should be deposited in the State library, and that similar specimens should be deposited in such of the literary institutions of the State as the Secretary of State should direct.

The act appropriated $26,000 annually, during four years, to defray the expenses to be incurred, and directed that the person or persons who should be employed should annually make a report to the Legislature before the 1st day of February, setting forth generally their progress in the survey.

I have received a communication from my predecessor, in which he informs me that on the first of January last the following persons were employed in the several departments, and for the compensation respectively mentioned, viz:

John Torrey, in Botany, salary,	$1,200	
Allowed for drawings,	300	
		$1,500
Lewis C. Beck, M. D. in Mineralogy, salary,	$1,200	
Allowed for drawings,	300	
Allowed for assistance and some expenses,	150	
		1,650
James E. De Kay, in Zoology, salary,	$1,500	
Allowed for drawings,	300	
		1,800
John W. Hill, in Zoology, employed as draughtsman,		800
Timothy A. Conrad, in Palæontology, salary,	$1,500	
Allowed for drawings,	300	
		1,800
William W. Mather, (1st district,) in Geology, salary,	$1,100	
Allowed for drawings,	300	
Allowed for cases for specimens,	175	
		1,575
E. Emmons, (2d district,) in Geology, salary,	$1,500	
Allowed for drawings,	300	
		1,800
Lardner Vanuxem, (3d district,) in Geology, salary,	$1,500	
Allowed for drawings,	300	
		1,800
James Hall, (4th district,) in Geology, salary,	$1,500	
Allowed for drawings,	300	
		1,800

I have received reports from Dr. Lewis C. Beck, Timothy A. Conrad, William W. Mather, E. Emmons, Lardner Vanuxem and James Hall. These reports are herewith submitted. I have received no report or communication of any kind from either Mr. John Torrey or Dr. James E. De Kay.

It affords me great pleasure to bear my testimony to the ability and fidelity with which the duties of those persons whose reports are submitted to you have been discharged.

Neither Dr. De Kay nor Mr. Torrey has hitherto made any report. By reference to a communication of the former gentleman submitted to the Legislature in February last, you will perceive that it is supposed that from the nature of the duties of himself and Mr. Torrey, partial reports cannot be made until their labors are brought to a close.

If the responsibilities resting upon them shall be discharged with ability equal to that of their associates, the Geological survey will abundantly repay the munificence of the State by numerous and lasting benefits.

It ought to be known to the Legislature that the collections of specimens will far exceed in number and value the expectations indulged at the time of the passage of the act, and cannot be profitably or conveniently deposited in the State library or in any apartments in the Capitol which can be appropriated for that purpose. The whole collection will form a museum of the highest scientific interest. Unless suitable arrangements are made for its preservation and exhibition, the benefits of the survey will be in a great measure lost.

I submit some suggestions on this subject made by the Geologists residing in this city.

WILLIAM H. SEWARD.

COMMUNICATION

From Messrs. Emmons and Hall, relative to a place of deposite for the different specimens collected by the Geologists.

To His Excellency Wm. H. Seward,
Governor of the State of New-York.

SIR—

We respectfully represent to your Excellency the urgent necessity of early providing for the proper disposition and arrangement of the specimens collected by the gentlemen engaged in the Geological Survey. That some definite disposal of them be soon made, is due not only to the individuals themselves, but to the people, who should be apprised of the extent and fruit of the enterprise which they have sanctioned.

Two plans have been proposed for this purpose. One is, the erection of a suitable building. We concur in recommending this as most accordant with the generous spirit which sanctioned the survey, although we are at the same time apprehensive that the necessary expense may deter from its adoption. The building in question should not be more than one story high, without windows, but lighted from the top, and of sufficient elevation to admit of a gallery round the upper part. A single room, if sufficiently large, will contain the whole collection; and in the rear of the rotunda, (for the room had best be circular,) might be one or two working rooms, for fitting and preparing the specimens.

As an alternative, it has been proposed to occupy the four corner rooms in the upper story of the new State Hall now building. The size of these rooms, (as we are informed by the superintendent of the building,) is 22 by 32 feet respectively, with an elevation of 10 feet. They are well lighted. The questions to be disposed of, prior to their occupation, are, whether they will be needed by the State officers; and again, whether the height may not be so great as to prevent the desirable attendance of visitors.

Some idea may be formed of the internal arrangement that is necessary from the following detail.

The Zoological specimens must be placed in glass cases, to preserve them from dust and decay. The smaller beasts and birds may thus be arranged along the walls, but the larger animals, as the moose, bear, wolf, &c. may require to be placed in the centre of one of the rooms, protected by glass on each side. The fishes, and several of the lower classes of animals, will need to be kept in spirits, and an outlay will therefore be required for it and the proper glass vessels. The insects and shells will probably show to most advantage in drawers covered with glass; and the drawers may form the lower part of the cases above suggested.

The Botanical specimens will require a separate case. They will be preserved in bound volumes, lettered according to the arrangement that may be adopted.

The major part of the collection, however, will consist of the Meteorological and Geological specimens, (including fossils.) These should all be arranged in cases covered with glass. And we respectfully suggest that a double suite of specimens be placed in the museum: one in the order which shall be agreed upon as most conformable to the existing state of science, and another geographically arranged; by which we mean, that a separate division be appropriated to each county in the State, and that the minerals, rocks and fossils found in each be placed together, leaving at the same time sufficient space for new discoveries.

The magnitude of this collection will be in some measure appreciated, when we state, that the number of minerals, rocks and fossils in this State will probably exceed 4,000. If it should be determined to preserve any of the soils, of course more room will be required for the specimens of each county.

In the above remarks we only intend to give a general idea of the preparation necessary to fit the rooms in question for the reception of the museum. The superintendent of the Hall states that they can be finished in August, and should it be determined to select them, the work needed for preparing the cases may be early put in hand.

Very respectfully, sir,
Your most obd't serv'ts,
EBENEZER EMMONS.
JAMES HALL.

Albany, *Feb.* 23, 1839.

REPORT

Of Dr. Lewis C. Beck, on the Mineralogical and Chemical Department of the Survev

To His Excellency WILLIAM H. SEWARD,
Governor of the State of New-York.

SIR—

In fulfilling the duty which the act authorizing a Geological Survey of the State imposes upon me, I propose not only to report my operations during the past year, but to present a general view of what has been heretofore done in the department committed to my care.

1. The State of New-York is so very rich in minerals, and the examination of their chemical characters is in many instances a matter of so much scientific and practical importance, as to require the most careful and patient attention. These investigations have necessarily occupied so much of my time, that I have thus far visited only some of our more important mineral localities. And so much still remains to be done in the chemical part of my work, that it will not be possible for me within the period prescribed for the completion of the survey, to give a much wider range to my field operations. But by the aid ot those gentlemen who are engaged in the minute survey of the different districts, I shall perhaps be enabled to present a sufficiently complete account of our mineral resources.

2. The following is a tabular view of the minerals which have hitherto been found in the State of New-York. In presenting it in this form, I beg leave to observe, that as this is a work which has been authorized by, and intended for, the people of the State, I think it proper to adopt that arrangement which will be most easily understood, and which, on the whole, appears to be best suited for a popular and practical treatise on the minerals and mineral waters of the State. I propose, however, to introduce into the final report all those descriptive

characters which the advanced state of the science to which it is devoted may seem to require. I may also observe, that the annexed table contains the names of those minerals only which have been found by myself, or published as New-York minerals, by others. Several doubtful ones collected during the progress of the survey, still remain to be examined; and when they have been, it is probable that the catalogue will be somewhat enlarged. I need scarcely say that I invite the attention of those who are engaged in similar pursuits to the general outline here presented, and solicit their aid in the completion of the work.*

Tabular View of the Minerals of the State of New-York.

CLASS I.

Gaseous Minerals.

Usually held in solution by water under pressure; but given out when the pressure is relieved.

1. *Combustible Gases.*

Those which burn upon the application of a lighted taper.

Hydrogen gas. Carburetted hydrogen gas. Sulphuretted hydrogen gas.

2. *Non-combustible Gases.*

Those which do not burn.

Oxygen gas. Nitrogen gas. Carbonic acid gas.

CLASS II.

Combustible Minerals, not gaseous.

Solid or liquid bodies which burn with ordinary degrees of heat.

Anthracite. Coal. Lignite. Peat.
Graphite. Bitumen. Sulphur. Amber.

CLASS III.

Uncombined Acids, not gaseous.

Sulphuric acid.

CLASS IV.

Alkaline Minerals.

Composed of one or more of the common alkalies, ammonia, potash, or soda, and usually containing an acid.

1. Ammonia.

Carbonate of ammonia.

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* My principal object in publishing this tabular view, at the present time, is, that I may profit by remarks and criticisms upon the proposed arrangement, and be apprized of any omissions in the catalogue of our minerals.

2. POTASH.

Muriate of potash. Hydrobromate of potash. Sulphate of potash. Carbonate of potash.

3. SODA.

Muriate of soda.
Hydrobromate of soda.
Sulphate of soda.
Carbonate of soda.

CLASS V.

ALKALINE EARTHY MINERALS.

Composed of one or more of the alkaline earths, baryta, strontia, lime, or magnesia, combined with water or an acid, and frequently containing some metallic oxide.

1. BARYTA.

Sulphate of baryta.

2. STRONTIA.

Sulphate of strontia. Carbonate of strontia. Barystrontianite.

3. LIME.

Muriate of lime.
Fluor Spar.
Nitrate of lime.
Anhydrite.
Gypsum.
Phosphate of lime.
Arragonite.
Calstronbarite.
Calcareous spar, and most of the varieties of carbonate of lime.

4. MAGNESIA.

Hydrate of magnesia.
Muriate of magnesia.
Hydrobromate of magnesia.
Sulphate of magnesia.
Carbonate of magnesia.
Dolomite.
Hydraulic limestone.
Rhomb Spar.

CLASS VI.

EARTHY MINERALS.

Composed chiefly of one or more of the earths proper; they frequently contain some alkali, alkaline earth, acid or metallic oxide.

1. SILICA.

a. Minerals in which the silica is nearly pure.

Quartz, (most of its varieties.)
Chalcedony.
Basanite.
Jasper.

b. Minerals in which the silica generally performs the part of an acid.

Tabular Spar.
Nemalite.
Serpentine.
Kerolite or Magnesite.
Talc.
Diopside.
Pyroxene.
Hornblende.
Byssolite.
Hypersthene.
Hydrous Anthophyllite.
Warwickite.

Chondrodite.
Boltonite.
Tremolite.
Asbestus.
Rensselaerite.
Terenite.

2. Alumina.

a. Minerals in which the alumina is nearly pure, or combined with an acid.

Corundum.
Spinelle.
Automalite.
Gibbsite.
Sulphate of Alumina.
Alum.
? Eupyrchroite.

b. Minerals composed principally of silica and alumina.

Idocrase.
Garnet, (several varieties.)
Cyanite.
Zoizite.
Seapolite.
Meionite.
Prehnite.
Staurotide.
Feldspar.
Labradorite.
Kaolin.
Spodumene.
Zeolite.
Laumonite.
Stilbite.
Mesotype.
Apophyllite.
Chabazie.
Pyrophyllite.
Epidote.
Chlorite.
Mica.
Tourmaline.
Clintonite.
Xanthite.
? Chiltonite.

3. Glucina.

Emerald.
Chrysoberyl.

4. Zirconia.

Zircon.

CLASS VII.

Metallic Minerals or Ores.

Composed either wholly or in part of the metals, commonly so called.

1. Iron.

Native iron.
Magnetic iron ore.
Specular iron ore.
Limonite, (several varieties.)
Sulphuret of iron.
Iron pyrites.
White iron pyrites.
Arsenical pyrites.
Cube ore.
Carbonate of iron.
Sulphate of iron.
Chromate of iron.
Phosphate of iron.?

2. Manganese.

Earthy oxide of manganese.
Babingtonite.

3. Zinc.

Blende, or sulphuret of zinc.

4. Lead.

Galena, or sulphuret of lead.
Sulphate of lead.
Carbonate of lead.
Molybdate of lead. ?
Vauquelinite.

5. Bismuth.

Native bismuth.

6. Copper.

Pyritous copper.
Carbonate of copper.

7. Titanium.

Rutile.
Crichtonite.
Titaniferous iron.
Sphene.

8. Molybdenum.

Sulphuret of molybdenum.

9. Arsenic.

Orpiment, or yellow sulphuret of arsenic.

10. Silver.

Native silver.
Sulphuret of silver.

In continuing my remarks upon the Mineralogy of the State, it will be convenient to follow the order here given. I shall, however, confine my attention chiefly to the more useful minerals.

Gaseous Minerals.

The nature of these bodies will be sufficiently understood from the definitions given in the table.

3. The first two, viz. *Hydrogen and Carburetted hydrogen*, are found among the gases evolved by many of our springs. Hydrogen gas is seldom abundant in its pure uncombined form, but carburetted hydrogen often contains an excess of hydrogen. Both these gases are characterized by their inflammability, and by their being destitute of the offensive odour of sulphuretted hydrogen gas.

Carburetted hydrogen is evolved by numerous springs in our State, extending from the valley of the Hudson to the shores of Lake Erie. In my last report I gave an account of such gas springs as were known to me at the time it was written; during the past season I have added a few others to the list, and the final report will embrace as complete a view as I can prepare of this interesting subject.

4. *Sulphuretted hydrogen gas.*—This gas is given out by what are commonly called sulphur springs, and which are found in almost every part of the State. The table appended to my report of last year, contains an enumeration of sixty-three of these springs. Twelve or fifteen have been added since, and the number will no doubt be still further increased. There are probably not less than a hundred important sulphur springs in the State. Many of these are still to be analyzed.

5. *Oxygen gas.*—This substance has been thought in some cases to be in excess in the gases given out by mineral waters, but if this be so, its occurrence is exceedingly rare. I have introduced it chiefly for the purpose of directing attention to the subject.

6. *Nitrogen gas.*—This is given out by what are termed nitrogen springs, to which class belong the celebrated Lebanon Spring, one or more in Rensselaer county, and one in Franklin county. Mr. Hall, the Geologist of the Fourth District, informs me that he has ascertained during the last summer that the Canoga spring, in Seneca county, also belongs to this class of springs. Nitrogen gas is here abundantly evolved from a pool twenty feet in diameter.

7. *Carbonic acid gas.*—This is copiously evolved by springs in various parts of the State, and constitutes an important ingredient in those of Ballston, Saratoga and Albany. When the water is highly charged with this gas, it is usually termed acidulous. But it often exists in smaller quantities, and forms what are called petrifying springs, from the fact that by an excess of carbonic acid a larger proportion of carbonate of lime is held in solution, and this carbonate is again deposited, when the water comes into contact with the air.

The notice of these gaseous bodies will therefore bring to view the whole subject of the mineral springs of the State, with the exception of the brine or salt springs, to be subsequently considered. It is my intention to trace on a skeleton map the localities of the most important of these springs, designating each by a particular character, and to prepare a complete table of them, arranged under the counties in which they are situated;—upon the plan of that attached to my last report.

Combustible Minerals, not gaseous.

8. *Graphite or plumbago.*—The localities of this mineral are very numerous in our State, but it is rarely found in quantities sufficient for any useful purpose. A mine, however, has been opened in the granite mountains south of Fishkill Landing, in Dutchess county, from which

some tons have been extracted.* There is also an important locality near the village of Alexandria, in Essex county.† This mineral is used in the manufacture of pencils, and for diminishing friction; it also constitutes the basis of the *silver lead*, extensively used as a coating for cast iron.

9. *Bitumen.*—Under this species is to be placed the oily bituminous substance called petroleum, and known with us by the names of Seneca or Genesee oil. There is a celebrated locality in the town of Cuba, in Allegany county.‡ It also occurs in Chautauque, Erie, Seneca and Albany counties, although in comparatively small quantities. It appears to have some connexion with the carburetted hydrogen gas evolved in various parts of the State. Other localities will probably be discovered during the progress of the survey.

10. *Sulphur.* This well known mineral, though for the most part confined to volcanic countries, has nevertheless been found in the State of New-York. It occurs in a pure form in a granitic rock near West-Point,§ and a few miles west of that place it has been found in a quartz rock. Small masses are also occasionally met with in the gypsum beds of Onondaga county, and it is not unfrequently deposited in a nearly pure form by waters charged with sulphuretted hydrogen gas. As the result of the decomposition of iron pyrites it is very abundant, but it is then almost always too impure to be classed under this head.

11. *Amber.* This mineral so constantly accompanies the beds of lignite and iron pyrites which occur in New-Jersey, that it will doubtless be found in the similar deposits on the western side of Staten-Island.

12. *Anthracite and Coal.*—There are many localities of these important minerals in this State, which must be noticed in the general work; but unfortunately, they have not hitherto been found in quantities sufficient for any useful purpose. Although large sums have been expended in researches for these minerals, and high expectations in some instances excited, they occur only in very thin layers, and in geological relations which differ entirely from those of the true coal measures.

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* *Prof. Mather's Report for* 1838.

† See an interesting notice of this locality by George W. Clinton, Esq. in the *Transactions of the Albany Institute*, I. 233.

‡ *Mr. Vanuxem's Report for* 1837; and Prof. Silliman's Notice of a Fountain of Petroleum in Allegany county, N. Y.—*Silliman's Journal*, xxiii. 97.

§ Major Douglass, in *Cleaveland's Mineralogy.*

13. *Lignite.*—This substance, which is merely mineralized or altered wood, is associated with iron pyrites in a bed of astringent clay near Rossville, in Richmond county. Some of the specimens have the appearance of wood charred by the action of an acid, as, for example, the sulphuric; and it is not improbable that this lignite owes its origin to the action of the excess of acid which this clay contains, upon drift wood from time to time deposited on this shore of the island.

14. *Peat.*—Of this useful, but in the State of New-York, almost entirely neglected combustible, we have already discovered numerous important localities; and many others will undoubtedly be added before the completion of the survey. The time cannot be far distant when the value of this article will be duly appreciated. In many countries it is extensively employed as fuel; and in several manufactures it might be used here with great advantage; as, for example, in the burning of bricks, of limestone, &c. Specimens from the most extensive peat bogs in the State should be analyzed to determine their composition. Some varieties of peat contain substances which render them unfit for culinary purposes.*

UNCOMBINED ACIDS, NOT GASEOUS.

15. *Sulphuric acid.*—This is the only mineral belonging to this class, which has, I believe, been found in New-York. An interesting locality of it occurs in Byron, Genesee county, of which I gave a particular account in my last report. The occurrence of this substance in such quantities is the more worthy of notice, as it is stated by the highest authority on this subject, "that sulphuric acid in a free state is found only in springs connected with volcanoes, to which it is obviously referable."†

ALKALINE MINERALS.

16. *Sulphate of soda.*—This salt, mixed with various proportions of other salts, is found in the form of an efflorescence on the calciferous slate of Mr. Eaton, near Rochester, Monroe county. It is also held in solution by the waters of some of the mineral springs found in the western part of the State.

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* For particulars concerning the mode of collecting and preparing peat, I would refer to *Dumas, Chimie appliquée aux Arts,* I. 587. This article seems to be at present exciting some attention as a manure.

† Dr. Daubeny's Report on Mineral and Thermal Waters.—*Transactions of the British Association for the Advancement of Science, for* 1836.

17. *Carbonate of soda.*—Found, in a nearly pure form, on the walls of several buildings in the cities of Albany and New-York. It is also an ingredient of the mineral waters of Saratoga and Ballston.

18. *Muriate of soda, or common salt.*—This important mineral is found abundantly in solution in the western part of the State, forming what are called salt or brine springs. Of these, I presented a view in my last report. Several others have been added to the list during the past year, and in the final work I intend to present a complete table of them, and to designate the localities of the most important ones on a skeleton map, with the other mineral springs.*

19. *Sulphate of potash*, *Muriate of potash*, *Hydrobromate of potash*, *Hydriodate of Soda.*—These are met with only in solution in mineral or sea waters.

ALKALINE—EARTHY MINERALS.

20. *Sulphate of baryta.*—This mineral, some varieties of which resemble marble, but are easily distinguished from it by their greater specific gravity, occurs in various parts of the State. At Pillar Point in Jefferson county, it may be obtained in large blocks, and is compact,

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* During the last session of the Legislature an act was passed authorizing "the Superintendent of the Onondaga Salt Springs to procure a set of standard instruments, and make observations once a week upon the strength of the brine in the different salt wells in use by the State, and state the result of such observations in his annual report to the Legislature." At the request of the superintendent and inspector at Salina, these instruments were constructed under my direction. Two objects were to be attained, viz: 1st, That the instruments, which from their particular use may be called *Salometers*, should be so sensible as to indicate slight differences in the density of the brine; and 2dly, That they should be made of some material less frail than glass, and not liable to be corroded by the brine. After a series of experiments in which I was assisted by Mr. Allen H. Gill, then in my laboratory, to determine the size of the bulb, length of the stem, &c.—they were constructed of silver, with the bulbs nearly two inches in diameter, the stems of flattened silver tube about twelve inches in length, and with a proper weight at the lower extremity. The graduation was accomplished by sinking one of the instruments to a certain depth in brine taken from the Salina well. The density and exact proportion of saline matter in this brine were then accurately ascertained. This gave one point. A known quantity of rain water was now added to this brine, and after allowing time for the mixture to be complete, the instrument was put into this diluted brine. It, of course, sunk lower than before, and having marked this point on the stem, as I did the former, the density of the mixture was ascertained. This gave two known points, and the graduation was then easily completed.

At the request of the officers at Salina, I graduated the instruments according to the centigrade scale, that is, distilled water being 0, and saturated brine 100°. Their range is from 10 to 12 degrees of this scale. The stems being about a foot in length, a difference of one-eighth of a degree, or of less than 4-100ths in the proportion of salt which the brine contains, can be easily detected. An increase in the range of the instruments would have impaired their delicacy, and the principal object for which they were constructed, viz. to determine whether the density of the brine is influenced by the seasons, by the height of the water in the lake, &c. could not have been attained.

variously coloured, and susceptible of polish. It is also found in St. Lawrence, Herkimer, Greene and Schoharie counties. In the latter, it occurs in various forms, and is associated with strontianite and other interesting minerals. The localities in this county I have not yet had an opportunity of visiting.

Sulphate of baryta is of considerable value as a paint. Ordinary white lead often contains a large proportion of this mineral. When it is of a white colour, which is often the case, it is difficult to detect this adulteration, in consequence of the specific gravity of the sulphate of baryta approaching so nearly to that of the white lead. The mixture answers equally well as a paint for most purposes, but it should be sold at a much cheaper rate than the unadulterated article. Both the sulphate of baryta of the northern part of the State and the carbonate of strontia of Schoharie, may become valuable as paints.

21. *Carbonate of lime.*—This important mineral is most abundantly diffused, and exists in vast strata under the name of limestone. There are several subspecies or varieties which are to be studied and described by the mineralogist. Among these may be enumerated:—*Calcareous spar*, of which this State affords some fine localities, as De Long's mill, in St. Lawrence county, and Ox Bow, in Jefferson, where specimens have been found quite equal to the celebrated Iceland spar;—*fibrous limestone*, *agaric mineral*, *and calcareous tufa;* of each of which we have several interesting localities. The most useful and important of these are what are usually comprized under the general name of

MARBLES.

22. The term marble, in strict propriety, should be confined to those varieties of carbonate of lime which are susceptible of a polish; including also some minerals in which the carbonate of lime is mixed or combined with other substances. In a wider sense, however, it may include all those varieties of limestone which are used for building purposes.

It is not my design at present to notice all the localities of marble in this State. The information which has been collected is not sufficiently ample to warrant such an undertaking. Enough, however, is already known to satisfy us that New-York possesses inexhaustible stores of marble, which must form an important item in her mineral resources.

23. The marbles of Sing-Sing and Kingsbridge in Westchester county, have long been used as building materials. Professor Mather will undoubtedly present full details concerning the extent and position of

the quarries from which these are obtained. I shall only add a few remarks concerning the mineralogical and chemical characters of the Sing-Sing marble, though I believe they are also generally applicable to all the marbles in this county.

24. The Sing-Sing marble is granular, and sometimes so friable that it can be crushed between the fingers. This tendency to disintegration is very manifest in those parts of the strata which lie near the surface of the ground, and have the appearance of beds of sand. This marble, moreover, frequently contains masses of tremolite, quartz, and grains or crystals of iron pyrites, the two former rendering it sometimes difficult to be worked, and the latter, by its decomposition, causing reddish stains, which detract from the beauty of the material. It is, however, found to improve with the extent of the excavations, becoming more compact in its texture, and more free from these foreign minerals.

The ease with which this marble can be worked, its good colour, and perhaps more than all, the facility with which it can be transported, will undoubtedly secure for it extensive use as a building material. The State being largely interested in these quarries, it is manifestly for its interest that the working of them should be conducted in the most judicious, as well as economical manner. By which I mean, that any reasonable outlay should be incurred, if by this means a finer and more durable kind of marble can be thus rendered accessible.

The marbles of Sing-Sing and Kingsbridge belong to the variety called Dolomite, which is characterized chemically by its containing a certain portion of carbonate of magnesia in combination with the carbonate of lime. I made a careful analysis of a specimen from Sing-Sing. It consisted of minute grains, was very friable, of a white colour, with a few dark spots. The composition was found to be as follows:

Silica, alumina, (with a trace of iron,)	0.87
Carbonate of lime, ...	53.24
Carbonate of magnesia,......................	45.89
	100.00

The lime afforded by the burning of dolomite is thought not to be generally applicable to the purposes of agriculture, in consequence of the magnesia which it contains. It is, however, well adapted to most building purposes, and if the views, recently suggested by Vicat are correct, it is not improbable that it may be found of great value as a cement. This subject will be noticed more in detail in a subsequent part of the report.

25. Beds of marble equal to those of Stockbridge and Egremont exist in various parts of Dutchess county, as in the towns of Northeast, Amenia, Dover, Pawlings, Beekman and Fishkill.* The Dover quarries are extensively wrought, and the marble which they afford, though dolomitic, is pure white, fine grained, and takes a higher polish than that found at Sing-Sing. Clouded marbles also occur in some parts of this county. All these, now comparatively neglected mines of wealth, would at once be opened up if some easy and direct mode of communication could be established between these quarries and the Hudson river.

26. Beds of marble similar to those above described, occur in the county of Putnam and in the interior of Columbia; while in the latter county, as well as in that of Ulster, dark coloured marbles are found, some of which take a fine polish, and are beautifully variegated with fossil remains. The town of Coeymans, in Albany county, contains a grey marble, which although it does not receive a good polish, is a valuable stone. In Schoharie county, black marble is found in the towns of Broome and Esperance; and the Cherry-Valley marble has long been celebrated.

27. In passing to the western part of the State, we have, in Oneida county, the Trenton limestones, which will furnish beautiful black marbles, and the grey marble near the Holland patent and on a branch of Steuben creek;† and in the counties of Madison and Onondaga the grey crinoidal limestone, which affords a marble scarcely excelled by any in the country for beauty, durability, and the fine polish which it receives. The quarries in Onondaga county are moreover very extensive, and yield blocks of great size. The marble is not only used for ornamental purposes, but in its dressed state is employed in the construction of locks, aqueducts, and other similar structures. The public works now building in the vicinity of Syracuse present a striking proof of the great superiority of this material over that formerly used for similar purposes, while at the same time they offer a no less striking illustration of the great advances which have been made in the arts of construction.

28. I have analyzed two specimens of the grey crinoidal limestone, the one from the quarry, near the Chittenango Falls, in Madison county,

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* See *Prof. Mather's Report for* 1838.

† *Mr. Vanuxem's Report for* 1838.

the other from the Split Rock quarry, in Onondaga county. The following are the results: No. 1 is from the former,—No. 2 from the latter.

	1.	2.
Insoluble matters, consisting of silica and alumina,.	0.90	0.40
Oxide of iron,..................................	0.35	0.20
Carbonate of lime, ...	98.50	99.30
	99.75	99.90

29. Wayne and Niagara counties also contain marbles of excellent quality, both for ornamental and ordinary purposes. The Lockport marble contains fragments of organic remains, which give to its surface, when polished, a variegated and beautiful appearance. It also frequently presents on fracture that singular columnar structure, at right angles to the layers, which has been quite aptly compared by Mr. Vanuxem to the sutures of the skull. In consequence of a suggestion made by that gentleman that the appearance in question was owing to sulphate of magnesia,* I subjected a specimen to analysis, and was somewhat surprised to find in it a large proportion of that earth. The composition is as follows:

Silica and alumina,..................	2.25
Oxide of iron,.......................	0.35
Carbonate of lime, ...	75.65
Carbonate of magnesia,...............	20.70
Moisture and loss,...................	1.05
	100.00

It will be interesting to ascertain whether this composition prevails in the rocks of this series.

30. In the northern part of the State the localities of marble are no less numerous and important than in the southern and western parts. Thus, in Washington county, there is a fine clouded variety near Granville; in Warren county, dove coloured marbles occur in ledges at the head of Lake George; and in Essex county, near Port Henry, is a white primitive lime-stone, which will probably be, when properly quarried, an excellent and beautiful building stone.

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* *Mr. Vanuxem's Report for* 1838.

In Clinton county, there is a black marble with organic remains, which takes a high polish and almost equals the Irish. In Franklin county, near Pottsdam, extensive beds occur of a white marble, which, although easily wrought, has a sufficiently compact structure. And finally, St. Lawrence county contains many localities of a similar kind; but the limestones found here are not usually susceptible of much polish in consequence of the foreign minerals which they contain.

Such is a hurried view of the principal depositories of marble in this State; and even from this it is quite apparent that both as it regards quantity and quality, our resources, in this important article, are ample. Its value to us is as yet scarcely appreciated. Every coming year must serve to unfold it. The number of our public works, and the increasing attention to the beauty and durability of building materials, must operate as inducements to the proprietors of quarries to test the properties of the strata which they contain. Such is the nature of our climate, that it is perhaps of more consequence here than in any other country, that materials for important structures should be carefully examined, and such only be employed as are proof against those destructive agencies which are so incessantly in operation.

31. The minerals of which I have just been treating, also furnish, by calcination, an article scarcely inferior in importance to any other. I refer of course to lime, the quantity of which annually consumed in this State, must be enormous. This quantity, moreover, must constantly increase, in consequence of the new uses to which it is applied; as for example, in agriculture, the preparation of chloride of lime, &c.

The following remarks from a report of Dr. Charles T. Jackson, on the geology of the State of Maine, will serve to convey some idea of the value of this article:

" Few perhaps realize the fact," says he, " that there are no less than fourteen millions of dollars worth of limestone within twenty feet of the surface in Thomason; and that already, while but a trifling portion of the stone is exported, nearly half a million of dollars are annually realized from the sales of lime; besides which, we also have to estimate the value of the carrying trade, the whole business being in the hands of the citizens of Maine." " The lime," the same gentleman remarks, " serves to supply nearly all the cities on the Atlantic coast with the lime used in their buildings, and for agriculture."*

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* *Second report on the Geology of the State of Maine, by Charles T. Jackson, M. D. &c.* 1838.

It should be observed that a great improvement has been introduced into the process of burning lime, which consists in the use of refuse screenings or dust of anthracite for fuel, instead of wood, and the employment of a perpetual kiln. The coal dust is said to have cost $1.75 per ton in the city of New-York, while from fifty to seventy-five cents per ton were paid for its transportation to Thomason.

Here, then, we have the singular fact that fuel is transported from the city of New-York to Thomason, and the lime procured by its agency again transported to the city. Now, the lime thus obtained must be greatly superior to that which is produced from our limestones, or else our citizens have been strangely neglectful of their interest in this respect. I have reason to believe that the counties of Westchester, Orange and Dutchess, contain limestones which would yield lime equal to any elsewhere manufactured. And with the improvements already introduced into our limekilns, as well as in those of Maine, one would suppose that our lime could be afforded at a much cheaper rate in the city of New-York, than that which is transported from a distant part of the United States. This subject commends itself to the enterprise of our fellow-citizens.

As my object is to notice the useful minerals of the State, I shall proceed to offer a few remarks upon a subject closely allied to the above, and the importance of which will, I think, be generally acknowledged. It is

The Hydraulic, or Water Limestones.

32. It is well known that the lime obtained by the calcination or burning of the different kinds of limestone, differs greatly in its properties. When the limestone is pure, the resulting lime is also of uniform purity. Upon the addition of water to such lime a high degree of heat is produced, its bulk is greatly increased, and it at length falls to powder. This powder, when mixed with water, and a due proportion of sand, and afterwards exposed to the air, gradually acquires a stony hardness; but this result is not produced when the mixture is submitted to the action of water. Now these are designated by the name of *air limes*, and their relative value depends in some measure upon the kind of limestone, and the particular mode of calcination.

But certain impure limestones when subjected to calcination afford limes which, while they do not undergo much change by simple exposure to the air, do not slake when moistened with water, but when reduced to powder, absorb this liquid without producing much increase in volume, and without the evolution of much heat; and they moreover form with it a paste possessing little tenacity, and which when placed under water, hardens after the lapse of a few days. These are now known by the name of *Hydraulic, or Water Limes.* They differ much in the rapidity with which they harden under water, and in the degree of solidity which they ultimately attain.

There are still other limestones which afford limes, possessing the remarkable and very useful property of becoming hard almost instantly, like plaster of Paris, whether exposed to the air or in contact with water. These are sometimes called *Roman Cements.* It should be remarked, however, that the French generally employ the term *ciment*, to designate fine pounded bricks or tiles; while in this country, the term *cement* is most commonly used in a generic sense, and includes the hydraulic constituent of mortars, whatever that may be.

It must always be considered as a most fortunate circumstance, that so soon after the commencement of the Erie canal, a material was found in its immediate vicinity, which yielded a lime well suited for the construction of locks and aqueducts. It is worthy of inquiry, however, whether in these and in similar works since constructed, sufficient attention has been paid to the selection and preparation of the hydraulic limes thus employed.

33. There is still some difference of opinion, as to which of the ingredients of these impure limestones, the hydraulic property is to be ascribed. Some of those who have examined the subject, have fixed upon the oxide of iron, as the important ingredient; while the claims of the oxide of manganese, silica, alumina, magnesia, and even soda, have each been urged by respectable authority. It is, after all, however, more than probable, that the hydraulic property is not due to a single ingredient, but belongs rather to several substances, or to a class of compounds.

It appears, from the experiments of Berthier and Vicat, the highest authorities upon this subject;—That no mixture, of which silica does not form a part, acquires hydraulic properties;—That limes containing only silica or alumina, or better those containing silica and magnesia, acquire a much greater degree of hardness than the silicates of pure lime; and that the oxides of iron and manganese contribute nothing to the hardening of these bodies.

More recently, M. Vicat has asserted, that magnesia alone, when in sufficient quantity, will render pure lime hydraulic. The proportions of magnesia which he recommends, are from thirty to forty per cent of it weighed after calcination, to every forty of pure anhydrous lime. "M. Vicat also points out the importance of these observations;—hydraulic lime never having been found in the calcareous formation below the lias, is because the dolomites have never been examined; but it is now probable that it may be found in this lower formation."*

It would be impossible in the compass of a report like the present, to enter fully into the consideration of this subject. Several important works have recently appeared in reference to it, which should be attentively studied by all who have the direction of aquatic structures. In France, where the arts of construction have for several years received such distinguished attention, much has been done towards establishing correct principles in regard to the preparation and mode of using hydraulic limes, cements and mortars. Valuable information will be found upon these points, in the extensive treatises of Dumas and Berthier, and in the able work of Vicat. Important service has also been rendered to the arts of construction in this country, by Col. Totten, who has translated and published in the Journal of the Franklin Institute, for 1837 and 1838, a very excellent memoir on hydraulic and common mortars, by General Treussart; and the same valuable periodical contains several other papers on those subjects which may be advantageously consulted.

34. As the proper selection and management of hydraulic limes is a matter of vast importance, I trust I shall be excused in adverting to a few points, to which there is reason to fear that sufficient attention has not been heretofore paid, in the construction of our public works.

1. It is agreed on all hands, that there is a great difference in the hydraulic limes obtained from different limestones, and that the value of each, and the proper mode of using it can be determined only by experiment.

2. It is admitted that in all cases the process of burning or calcining the limestone requires great care. A limestone, very proper in other respects, gives, when the heat is urged too high, what is called a *dead lime*, in consequence of the partial fusion of the mass; whereas, when the calcination is effected at too low a temperature, the resulting lime is meagre and not hydraulic.

3. Hydraulic lime should be used as soon as possible after calcination, and when kept for any time, it should be carefully protected from the

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* *London and Edinburgh Philosophical Magazine, &c. 3d Series,* VIII. 591.

action of the air. It has been ascertained that the hydraulic property of limes is much weakened by their being exposed to the air, and consequently, all other things being equal, recently prepared hydraulic lime is to be preferred for important structures, to that which has been for some time manufactured.

4. It is generally agreed that the rapidity with which hydraulic mortar hardens, and the ultimate degree of hardness which it acquires, depend greatly upon the proper proportions of lime and sand, their intimate incorporation, and the amount of water employed in their mixture. All these are points which must be settled by previous experiments.

35. The leading principle involved in the hardening of these hydraulic compounds, seems to be, that certain earthy substances, and especially silica, combine with the lime to which the carbonate of lime in these hydraulic compounds is brought by calcination, and that the silicate thus formed, is converted into a solid hydrate by combination with water. The *setting* of boiled plaster, when made into a paste with water, affords the best illustration of the kind of change which these hydraulic compounds undergo during the process of hardening in contact with water. The selection of the raw material and the different steps of its preparation, must have in view the complete fulfilment of this necessary condition.

I shall now proceed to notice some of the most important localities of hydraulic limestones in this State, and give the results of the analyses made in reference to this subject.

36. Hydraulic limestone is found in great quantities, in Ulster county, and the manufacture of cement has for several years been there quite extensively carried on. Recently, however, it has increased in a surprising manner, though it is probably, still only in its infancy.

The principal quarries of hydraulic limestone, at present opened in this county, are situated on the Rondout, and the Hudson and Delaware canal, but the strata are undoubtedly of great extent. The mode of preparing the cement is sufficiently simple. The limestone is first reduced to small fragments, which are then thrown into a kiln, with layers of the screenings of anthracite intermixed. At an interval of twelve hours, the lower layers of the kiln are removed, and fresh portions of the limestone thrown into the upper part. These operations are so managed, that each layer is subjected to heat for about three days.

The lime thus calcined, is of a light drab colour, and when reduced to powder and mixed with about one-third its bulk of sand and made into paste with water, soon becomes hard. The grinding is performed in a mill, and the powdered cement is put up in barrels, which are lined with paper, to exclude as much as possible, the contact of air. The cement thus prepared, is sold at $2.25 the barrel.

It is estimated that about 3,000 barrels of cement are manufactured in this district, weekly. Supposing this to be continued for only six months in the year, the income arising from it will amount to nearly $150,000. As an evidence of the good quality of this cement, it may be stated, that it is employed in the construction of the Croton aqueduct and in the United States works, near Boston.

37. I analyzed a specimen of this hydraulic limestone, or cement, as it is sometimes called, from the quarry of Messrs. Moser & Burnett. It had a blueish colour, with occasional gray and reddish spots. The texture was close and compact, and its fracture even or conchoidal. The following are the results which were obtained in 100 parts.

Carbonic acid,	34.20
Lime,	25.50
Magnesia,	12.35
Silica,	15.37
Alumina,	9.13
Oxide of iron,	2.25
Bituminous matter, moisture and loss,	1.20
	100.00

The calcined cement contained only five per cent of carbonic acid, and its composition may be thus expressed.

Carbonic acid,	5.00
Lime,	37.60
Magnesia,	16.65
Silica,	22.75
Alumina,	13.40
Oxide of iron,	3.30
Loss,	1.30
	100.00

By calcination, therefore, this limestone is reduced to a state approaching that of a double silicate and aluminate of lime and magnesia, and the theory of the hardening of this cement is sufficiently in accordance with the views above suggested. The cement, moreover, forms a jelly with muriatic acid, which still further proves that its chemical nature has been changed during the calcination.

38. An important practical inference from these experiments and observations is, that the more completely the carbonic acid is driven off from the limestone by calcination, without causing its fusion, the more energetic will be the resulting product. It is probable that a long continued, rather than a very high, heat, will best effect this object.

39. It remains to be mentioned, that the limestone which over lies this cement has a blue colour, a structure somewhat granular, contains organic remains, and occasionally nodules of calcareous spar and sulphuret of zinc, with alternating layers or masses of hornstone. On analyzing a fragment of this rock, I found it to consist of carbonate of lime, with a minute portion of oxide of iron and bituminous matter, and with about eight per cent of argil, or silica and alumina. It does not contain even a trace of magnesia, although so closely associated with the magnesian stratum above described.

40. Water limestones occur in Albany county, in the Helderberg;* in Montgomery county, about ten miles northwest of Schenectady; also in Herkimer county, some of which Mr. Vanuxem thinks would afford cements equal to any elsewhere made in the extensive range to the west; while, according to the same geologist, they are found in immense series in Oneida county.†

41. The hydraulic limestone of Madison county has long been in high repute. One of the most important localities, and I believe one of the first, if not the very first, discovered in the State, is situated about a mile and a half southwest of the village of Chittenango. It has usually a drab colour, sometimes striped with reddish bands, a conchoidal fracture, an earthy texture, and is covered by layers of the calciferous slate of Eaton. The process of burning and grinding is similar to that heretofore described. When this cement is used in the construction of works, it is mixed with from two to three parts of sand.

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* I have not yet had an opportunity of analyzing a specimen from this locality. According to an analysis of Prof. Eaton, which, however, he did not deem very accurate, it contains 25 per cent carbonic acid, 26 lime, 28 silica, 18 alumine and magnesia, 1 iron, and 2 water.—*Transactions of the Albany Institute, vol.* 1, *app.* p. 53.

† *Mr. Vanuxem's Report for* 1838.

It is computed that 100,000 bushels of hydraulic lime are annually sent from this town. The average price is fourteen cents a bushel, which therefore yields a return of $14,000.

42. The following are the results of two analyses of hydraulic limestone from this county; the first, by Mr. H. Seybert;* the second, by myself.

	1.		2.
Carbonic acid,	39.33		38.65
Lime,	25.00		27.35
Magnesia,	17.83		16.70
Silica,	11.76		8.95
Alumina,	2.73		4.90
Peroxide of iron,	1.50		1.75
Moisture,	1.50	Moisture, bituminous matter & loss	1.70
	99.65		100.00

The composition of the calcined lime in the state in which it is ordinarily used as a cement, is as follows:

Carbonic acid and moisture,	10.90
Lime,	39.50
Magnesia,	22.27
Silica,	16.56
Oxide of iron and alumina,	10.77
	100.00

The proportion of carbonic acid, however, depends entirely upon the manner in which the calcination is conducted, and it probably differs considerably in different specimens.

43. The blue fetid limestone which is associated with the water lime is a nearly pure carbonate of lime, containing 0.70 per cent of insoluble matter, and a trace of oxide of iron and bitumen, to which last is probably to be ascribed the odour which it gives out when struck with a hammer. It contains no magnesia.

44. I have also analyzed a specimen of the calciferous slate of Eaton, from the hill on the east side of the village of Chittenango. The results are as follows:

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* *Transactions of the American Philosophical Society. New Series,* II. 229.

Carbonic acid,	40.95
Lime,	29.00
Magnesia,	17.30
Silica and alumina,	11.00
Oxide of iron,	1.10
Moisture and loss,	0.65
	100.00

If this composition is constant, it is not difficult to account for the occurrence of sulphate of magnesia or Epsom salt, which is so often found in efflorescences on this rock. It contains a sufficient amount of sulphuret of iron to furnish the acid for this decomposition.*

45. An important locality of water limestone occurs about a mile and a half west of Manlius in Onondaga county. The overlying rock is a blue limestone, similar to that found at Chittenango. Some of the strata of water limestone are clouded or striped, while others are of a uniform gray or drab colour. Through the upper layers there passes a thin seam of white calcareous spar, in which are to be found small crystals of fluor, of a dark purple colour.

The cement manufactured at this quarry is used in the construction of the aqueduct at Syracuse, and in that of several of the locks on the enlarged canal.

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* Since the above was written, I have analyzed a specimen from the bed of the river at Rochester, Monroe county; called "calciferous slate" by Prof. Eaton, and "calcareous shale" by Mr. Hall. It is greyish blue, granular, a little crystalline, and emits a strong bituminous odour when struck or subjected to heat. Its composition is as follows:

Carbonic acid,	35.00
Lime,	25.20
Magnesia,	14.50
Silica, with a little alumina,	24.00
Oxide of iron,	1.00
Bituminous matter,	0.30
	100.00

I have also analyzed a specimen of the tufa or petrified wood found at the base of the hill of calciferous slate at Chittenango, for the purpose of ascertaining whether magnesia was one of its constituents. The following is its composition.

Carbonic acid,	42.05
Lime,	53.95
Silica, alumina, and vegetable matter,	2.10
Oxide of iron,	0.80
Moisture and loss,	1.10
	100.00

It does not contain even a trace of magnesia.

46. The Manlius water limestone has the following composition:

Carbonic acid,	39.80
Lime,	25.24
Magnesia,	18.80
Silica and alumina,	13.50
Oxide of iron,	1.25
Moisture and loss,	1.41
	100.00

47. According to Mr. Hall the formations from which water limestone has been selected, extend across Monroe county from east to west: the one through the towns of Penfield, Brighton, Gates, Ogden and Sweden; the other through Mendon, Rush and Wheatland. At one locality in Ogden this limestone has been burned and used for cement in the locks on the Erie canal, and is said to have been of good quality. The same kind of stone may be found at the upper falls of the Genesee, at Rochester.*

In Orleans county, some of the upper layers of the rock at the falls of Oak Orchard creek, at Shelby, are also used for the manufacture of water cement.

48. Finally, the same limestone occurs near Waddington, in St. Lawrence county, and is probably continuous with the stratum found near Kingston in Upper Canada, which is used in the public works and is highly esteemed.†

Such are some of the most important localities of this valuable mineral product. The number of these will no doubt hereafter be much increased, and perhaps many quarries, now little valued, will be found upon examination and trial to furnish cements equal to those at present so generally employed. It cannot be too often repeated, however, that a detailed and careful series of experiments should be made before a cement, from whatever locality obtained, is used in important works.

GYPSUM, PLASTER OF PARIS, OR SULPHATE OF LIME.

49. This important article, for which until within a few years past we were almost entirely indebted to Nova Scotia, may now be ranked among the great mineral products of our State.

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* Prof. Hall's report for 1838.

† The value of the water lime manufactured in St. Lawrence and exported to Canada, is said to be $40,000 annually. See *Report of the St. Lawrence rail-road committee, December*, 1838.

Gypsum, when pure, has a snow white colour, but it is often tinged with red, yellow, blue and grey, in consequence of the admixture of foreign substances. When crystallized, it is foliated, but it also occurs granular and compact. The foliated varieties are called *selenite*, while the compact ones are often known by the name of *alabaster*. It is distinguished from carbonate of lime by its being less hard, as it may be scratched by the finger nail; acids, when applied to the carbonate of lime, cause an effervescence, owing to the escape of carbonic acid,—but no such effect is produced by a similar application to the sulphate of lime.

The variety of sulphate of lime which is most abundant, is composed of sulphuric acid and lime, with about twenty per cent of water. Whenever it is used for architectural purposes, this water is driven off by the application of heat, the operation being commonly known by the name of *boiling*. The calcined or boiled plaster, when made into a paste with water, speedily hardens, and it is employed in this way for walls, for stucco, for taking casts of statues, in stereotyping, &c. Gypsum is moreover largely used in agriculture, and it is considered an invaluable fertilizer.

Of this useful mineral we have numerous and very important localities. They are, however, almost exclusively confined to the district bordering on the Erie canal. I am aware that it occurs in the counties of Columbia, Albany and Schoharie, but however interesting the specimens here procured may be for the cabinet of the mineralogist, the quantity is nowhere sufficient to answer any other purpose.

50. The west end of the town of Starke, in Herkimer county, is the most eastern point at which gypsum has been found in any great quantity. According to Mr. Vanuxem, it occurs in a white sandstone, the grey band of Mr. Eaton, and he represents it as being white and equal to the Nova Scotia both before and after calcination. From twenty to thirty tons had been obtained by Mr. Crill, the proprietor, during the summer of 1837.

51. In Oneida county, gypsum is found in beds of vast extent. It is sometimes pure, being foliated and transparent; but the largest proportion is dark coloured, and is mixed with carbonate of lime, constituting what is usually called *plaster stone*. This last is used for agricultural purposes, and when deprived of its water by calcination, as a cement.

52. Localities of this mineral abound in the county of Madison. It is sometimes foliated and granular, but usually, as in the above county, it belongs to the common or impure variety. It occurs imbedded in gypseous marl, every where forming irregular or somewhat rounded or conical masses rarely more than forty or fifty feet in diameter, and usually from ten to twenty feet in height. These hillocks seem to be detached, and the conclusion is almost irresistible that they have been formed after the upper strata of rock have been deposited. The masses of gypsum are a foot or more in thickness, and weigh from four to six hundred tons. I can give no details concerning the amount of this mineral annually raised in this county, but in the town of Sullivan alone it is said to be from four to seven thousand tons.

On the route from Chittenango to Syracuse, in Onondaga county, conical elevations similar to those already noticed are of frequent occurrence; some of which have already been opened and found to contain deposits of gypsum, while others are left as the reward of future enterprise and labor.

53. The interesting region around Onondaga lake, of which I have heretofore attempted to give an account, contains, in addition to its other sources of wealth, some important deposits of gypsum. At Liverpool, the fibrous variety, then comparatively rare in this State, was found several years since, about twelve feet below the surface of the earth, associated with marly clay. Recently the excavations made for the construction of the rail-road from Syracuse to the Split-Rock quarry, have opened an extensive bed of the same valuable mineral. At this locality are to be found several varieties; as the foliated, the fibrous, the snowy, and the common or dark coloured—the whole imbedded in a kind of gypseous marl which effervesces freely in acids, and contains variable proportions of the oxide of iron. Gypseous beds, similar in their general characters, also occur in the vicinity of Manlius, from which large quantities have been exported. But probably the most valuable deposits that have yet been opened up are those along the line of the Syracuse and Auburn rail-road, near the village of Camillus. We find here, among other varieties, noble specimens of transparent selenite, and what renders the locality peculiarly interesting, are the associated strata of calcareous tufa, and of the singular hopper-form crystals of marly clay. From forty to fifty thousand tons of gypsum have been obtained simply from the excavations which were necessary for the construction of this road. And this may be considered as merely a specimen of what is still hidden in the adjoining hills.

54. Beds of gypsum occur in various parts of Monroe county. Specimens of the foliated variety, with a rose colour, have been found below the Genesee Falls at Rochester, and nodules of snowy gypsum are quite common in the calciferous slate at the same place. Gypsum is also obtained in small quantities in the towns of Pittsford, Riga and Chili; but, according to Mr. Hall, the workable beds of this mineral are almost wholly confined to the southern part of the county. "Along the valley of Allen's creek and Mill creek, two miles north, most of the plaster of Monroe county is obtained. Both these places are in the town of Wheatland. At present, about 5,000 tons of plaster per annum are obtained from this town; of this quantity, 4,000 tons are used in Monroe county."*

55. In the counties of Cayuga, Wayne, Livingston, Ontario, Seneca and Tompkins, beds of gypsum have been found in various places; but I have no means of determining even the probable quantity which they yield.

56. The localities of this mineral in Niagara county are of considerable interest to the mineralogist. At Lockport, beautiful specimens of transparent selenite and snowy gypsum have been found, associated with pearl spar, sulphate of strontian, and the rare anhydrite or anhydrous sulphate of lime. Snow white granular gypsum also occurs near the Falls of Niagara, with occasional specimens of foliated selenite of a fine sky-blue colour. At all these localities, the gypsum is imbedded in the geodiferous lime-rock of Professor Eaton, but it does not, to my knowledge, occur in quantities sufficient for useful purposes.

57. A very imperfect idea of the quantity of gypsum which exists in this State, will be obtained from the sketch which has now been given. Even if we had the means of ascertaining exactly the number of tons at present annually raised, which I think cannot be less than 50,000, it should be borne in mind that regular explorations are seldom undertaken, and that the amount, whatever it may be, is mainly the result of accidental discovery, and of occasional labor by the farmer during the intervals of his other avocations. Immense beds still lie unopened, which will at some future day yield their treasures. Perhaps one reason why greater attention has not been paid to the enormous deposits of gypsum and marl which exist in the western part of the State is, that the soil is naturally so fertile as seldom to require the employment of those artificial means of renovation which in most other

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* *Hall's Report for* 1838.

countries are necessary to the success of the agriculturist. Still it cannot be doubted that in many situations even here, much advantage would be derived from the use of these efficient fertilizers. Lime, marl and gypsum, all of which can be so easily and so abundantly obtained in the region in question, have almost entirely changed the agricultural character of the States of New-Jersey and Pennsylvania; but it appears to me that in no part of our State which I have visited, is the value of these articles duly appreciated.

It may not be out of place here to offer a few remarks concerning the origin of gypsum.

58. From the uniformly regular appearance which the beds of gypsum present throughout the western counties, the similarity in their geological associations, and the apparent heaving up of the strata which enclose them, it has been inferred that they are the result of agencies now in operation. The opinion indeed prevails quite generally among the inhabitants of the districts where plaster beds are of most frequent occurrence, that they increase from year to year, and that it is unsafe to commence important structures in situations where they are supposed to exist.

It seems not improbable, that the sulphate of lime has been formed subsequently to the deposition of the strata of limestone in which it is found, and that it may belong to that class of bodies whose formation is continually going on. The decomposition of the sulphuret of iron, and the subsequent action of the sulphuric acid thus produced, upon limestone, has by some been proposed as the mode in which this is accomplished. But a formidable objection to this view is, that iron pyrites, although a very common mineral, is not yet found in sufficient quantity to account for the vast results which have been ascribed to it. Thus in the western part of New-York, the occurrence of gypsum, the formation of vast beds of iron ore, and the production of the immense number of sulphur springs which are known to exist there, have all been referred to the decomposition of this single mineral.

If all these phenomena were really due to the decomposition of iron pyrites, it would be fair to infer that this substance existed in enormous quantities, and that beds of oxide of iron, resulting from this decomposition should uniformly be found in the immediate vicinity of our plaster beds and sulphur springs. But the facts in the cases do not accord with the theory.

59. In the account which I gave, in my last report, of our sulphur springs, or those which evolve sulphuretted hydrogen, it was remarked that the common explanation of the production of this gas, viz: the decomposition of iron pyrites, seemed to me to be quite unsatisfactory. The doubts then expressed, have been rather confirmed than removed by the discovery of several other springs of the same kind, in various parts of the State. During the past season, I visited, in company with Mr. Vanuxem, Dr. Wright of Syracuse, and Mr. W. P. Wainwright of New-York, a lake or pond, two miles east of Manlius Centre, known in that vicinity, by the name of Lake Sodom or Green Pond. This pond is about a mile and a half in length, and half a mile in breadth, at the widest part. The water is of a deep green colour, which is probably owing to the partial decomposition of the sulphuretted hydrogen which it holds in solution. The depth of the water gradually increases as we proceed from the northern outlet, from twenty-five to a hundred and sixty-eight feet; the latter depth continuing for some distance around what we supposed to be the centre of the basin. Water drawn from the depth of 168 feet, was found to be strongly charged with sulphuretted hydrogen. On being afterwards tested, it blackened nitrate of silver powerfully, and gave copious precipitates with solutions of oxalate of ammonia and muriate of barytes, indicating the presence of sulphuretted hydrogen, and sulphate of lime. Its specific gravity was scarcely above that of distilled water, and it contained not even a trace of iron.

Here then is a natural sulphur bath, of a mile and a half in length, half a mile in width, and 168 feet in depth; and this, let it be remembered, is neither a solitary, nor as it regards extent, an uncommon locality, in the western part of the State. Surely there must be some very general and powerful cause in operation, to produce such vast results. The few scattered grains of iron pyrites, which some of our rocks contain, are as entirely inadequate to these phenomena, as they are to those of the volcano and the earthquake.

60. As all our sulphuretted waters, without exception, contain sulphate of lime, and as sulphur springs are most numerous and extensive in those parts of the State where gypsum beds abound, it is, I think, a fair inference, that the production of gypsum and the evolution of sulphuretted hydrogen are referable to the same general agency. Now as it is known that the decomposition of the sulphuret of calcium, or the compound of sulphur, and the metallic basis of lime, by water, will give rise to sulphuretted hydrogen and sulphate of lime, it is not improbable that there exits beds of this substance, at different and unknown

depths, to which all these phenomena may be ascribed. The access of water to these beds of sulphuret of calcium, causes its decomposition, and as a necessary consequence, gaseous sulphuretted hydrogen is evolved. This gas, in its course to the surface, is partly absorbed by water, while, from its reaction upon that liquid, a portion of sulphuric acid is also formed, a result which we constantly observe in the laboratory. The sulphuric acid thus formed, acting upon the upper strata produces sulphate of lime, and causes the evolution of carbonic acid, a substance which is almost always found in the mineral waters of the west.

This view appears to me conformable to the known laws of chemistry, and is sustained by the facts which are presented. The only assumptions, are the existence of the sulphuret of calcium, in quantities sufficient to produce these results, and the agency of water. In regard to these, I will here only remark, that they are supported by the same train of argument, that is brought to bear upon the chemical theory of volcanic action; of which action, many evidences, in addition to those above noticed, are presented in various parts of our State.

EARTHY MINERALS.

61. The minerals included under this class are composed chiefly of one or more of the earths proper; frequently, however, containing some alkali, alkaline earth, acid or metallic oxide. They have also sometimes been termed earthy compounds or stones, and they are probably more interesting to the mineralogist than those belonging to any other class. In some cases, the composition of these minerals is very complex, which renders their analysis difficult. At the same time, this very circumstance makes their careful study the more important, and as slight differences in chemical composition not unfrequently form the basis of specific distinctions, increases the chances of new discoveries. To show that I have not been inattentive to this part of my work, I beg leave to state, that a portion of every season since its commencement has been devoted to the collection and study of the minerals belonging to this class. Seven or eight weeks of the last summer were spent among the rich localities of Orange county, in company with my friend, Dr. Wm. Horton, who is so well acquainted with the minerals of that county, and who was then engaged in examining its geology as the assistant to Prof. Mather. I should do injustice to my own feelings, did I not thus publicly acknowledge the important assistance which I have at various times received from Dr. Horton, who has perhaps done as much, if not more, than any other individual towards bringing into notice the vast mineral resources of Orange county.

Upwards of twenty boxes of minerals, belonging chiefly to the above class, were obtained during the past season, and are deposited in the geological rooms, in the capitol. But as I proposed to confine this report principally to our useful minerals, I shall at present notice only those which can properly be arranged under this head.

MAGNESIAN MINERALS.

62. Several minerals are found on Staten-Island, and also in other parts of the State, which, in consequence of their containing large proportions of magnesia, may properly enough for my present purpose be grouped together under the name of magnesian minerals. Some of these may be turned to account in the arts.

The mineral called serpentine constitutes the principal ridge of hills on Staten-Island, extending from New-Brighton to a little west of Richmond, a distance of eight miles. It assumes a great variety of aspects, from black to nearly white, and from compact to earthy. Some of the talcy varieties are commonly known by the name of soap stone. Talc, carbonate of magnesia and hydrate of magnesia abound in it, and the rock might be used with profit in making magnesian salts.*

The suggestion here made in regard to the preparation of magnesian salts from the minerals so abundant on Staten-Island, is deemed of great consideration. These minerals contain from one-third to two-thirds of their weight of magnesia, as will be seen from the following results of their analysis.

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* *Prof. Mather's Report for* 1838.

	Magnesia.	*Lime.*	*Carbonic acid.*	*Water.*	*Silica.*	*Protoxide of iron.*	*Peroxide of iron.*	*Peroxide of iron and alumina.*	*Foreign matters and loss.*	*Total.*
Hydrate of magnesia,.........	70.00	....	....	30.00	....	....	....	....	......	100*
Hydrocarbonate of magnesia,...	42.41	....	36.82	18.53	0.57	....	0.27	....	1.40	100†
Compact carbonate of magnesia,.	44.00	3.50	50.00	....	2.00	0.50	....	....	......	100‡
Magnesite or kerolite,.........	41.26	2.39	....	13.50	41.00	....	....	1.85	......	100§
Common serpentine,..........	42.16	....	1.03	12.33	42.26	1.98	....	....	......	‖99.76

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* Bruce, in *American Mineralogical Journal*, I. 26.
† Wachmeister, see *Silliman's Journal*, xviii. 167.
‡ Nuttall, in *Silliman's Journal*, iv. 17.
§ By my analysis. The specimen was from Staten Island.
‖ *Thomson's Mineralogy*.

The magnesia contained in either of these minerals would furnish, by combination with sulphuric acid, upwards of two hundred parts of sulphate of magnesia or epsom salts, in the form in which it is ordinarily sold in the shops. Moreover, the sulphate of magnesia, thus obtained, may be decomposed by carbonate of soda or potash and produce carbonate of magnesia, which, as well as the sulphate, is used for medicinal purposes.* By this operation, when serpentine is employed, a large quantity of Venetian red is also procured, as that mineral contains a considerable proportion of oxide of iron. This manufacture is now carried on near Baltimore, in Maryland, and there seems to be no reason why it may not be profitably pursued in the vicinity of New-York.

63. Serpentine, similar in every respect to that found on Staten-Island and at Hoboken, in New-Jersey, occurs in considerable abundance in the counties of New-York, Westchester, Putnam, Rockland and Orange; and extensive deposits of the same mineral are also found in the county of St. Lawrence.

The beautiful green colour of serpentine, and the fine polish which it takes when pure, give it great value as an ornamental marble. When mixed with granular limestone it forms the celebrated *verd antique.* Unfortunately in almost all the localities in the southern part of the State, at least so far as they have been explored, the serpentine, although in great abundance, is so mixed with carbonate of magnesia, asbestus and other magnesian minerals, as to render it unfit to be worked as a marble. Thus a block obtained from a quarry in the county of Westchester, concerning which high expectations had been raised, was found to have an unequal degree of hardness in its different parts, and to be filled with seams and nodules of other magnesian minerals which could not be polished, or were too friable to sustain the rough usage which is required for the dressing of marble.

Prof. Emmons informs us that there are several localities in St. Lawrence county in which the soundness of the serpentine rock is remarkable; and the only impediment to the introduction of this article for ornamental and useful purposes, he thinks, is the expense of transportation. At Pitcairn is a fine locality of *verd antique.* The colours are green and white, arranged in the usual forms of clouded marble. The serpentine has a bright green colour, and belongs to the variety usually called precious. The carbonate of lime is white, and forms a handsome ground for the translucent serpentine.*

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* Should the preparation of these salts of magnesia become important, the dolomites or double carbonates of lime and magnesia which occur at Sing-Sing and elsewhere, may be also advantageously employed for that purpose. The double carbonate is first to be calcined and then treated by sulphuric acid, or sulphate of iron. There is thus formed an insoluable sulphate of lime and a soluble sulphate of magnesia, which can be easily separated.

64. Usually associated with serpentine, when it occurs in extensive beds, is a mineral which has nearly the same chemical composition, generally known by the name of soapstone. This is particularly the case in the counties of Richmond and St. Lawrence. In consequence of its softness and tenacity soapstone may be turned or cut into articles of various shapes, and rendered hard by exposure to heat. It is hence much used for the hearths of furnaces, the sides of fire places, the linings of stoves, and for similar purposes.

65. Another substance often found with these magnesian minerals is asbestus, under which I include the variety composed of flexible silky fibres, sometimes known by the name of amianthus, there being no line of specific distinction to warrant its separation. This mineral has acquired notoriety from the fact that some of its varieties may be woven into cloth which is indestructible by heat. It is to uses similar to these that it is accordingly applied, being employed in the preparation of the incombustible cloth proposed for firemen's robes, and for the lining of the metallic safes now so generally introduced into counting houses.

MATERIALS FOR THE MANUFACTURE OF PORCELAIN.

66. The localities of clays suitable for the manufacture of brick and the common kinds of earthern ware, are too numerous in this State to be at present noticed, and their description belongs rather to the department of geology than to that of mineralogy. Many of these have already been noticed in the reports of the geologists, and Prof. Mather has presented some details which show the importance of the branch of industry included under the art of brickmaking.

The manufacture of the finer kinds of pottery has not heretofore been carried on with much success in our country. Whether this be owing to the superior facilities which are possessed by the English and French in regard to materials, or to the reduced price of labour, it is not easy to determine. My present object is merely to show that New-York is not destitute of the materials necessary for this branch of art.

The finer kinds of pottery require for their manufacture the purest clays,—such as contain little or no oxide of iron and which consequently do not turn red in burning. To these a portion of pure silica is added, which is prepared for the purpose by heating masses of flints or quartz, quenching them in water and then reducing them to powder in a mill.

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* *Prof. Emmons' Report for* 1838.

67. Clays of a good quality occur abundantly in various parts of Staten and Long-Island, and upon proper trial they would no doubt be found to answer the purposes of this manufacture. There are also several localities in Orange county where similar materials may be obtained.

Near Southfield furnace, in the latter county, is a bed of decomposed feldspar known by the name of porcelain earth, which will probably be of great value in the manufacture of pottery. This substance is of a pure white colour when dry, a little unctuous, and is supposed to be abundant.

68. As for feldspar used in glazing and also in the body of the finer kinds of pottery, we have several localities in Orange county, in Warren county, near Caldwell, and also in the counties of Jefferson and St. Lawrence; while quartz, of a good quality and in sufficient abundance for the same purpose, is found in Orange, Columbia and other counties.

69. Those who are at all acquainted with the history of the arts both in this and in other countries, must be aware that their progress has oftentimes been extremely slow, and it will not be surprising if the manufacture in question, although now of so little value to us, should become an extensive and important one. Previously to about the year 1760, England depended wholly upon other countries for the finer kinds of pottery;—the English ware being generally of an inferior quality. But in a few years after the investigations and consequent improvements of Mr. Wedgewood, the current of importation of even the finer earthen wares was changed in that country to exportation, and their manufacture has at length become of such vast extent that it is not easy to calculate its value.

So it has been with many of the arts now successfully prosecuted in our own country. A great number of articles, for which we were but a few years since entirely dependent on foreign nations, are now manufactured by our mechanics and in our own workshops.

METALLIC MINERALS.

In my report for 1837, I described the principal localities of the ores of iron and lead in this State, at least so far as I was then acquainted with them. Much additional information has been acquired in regard to these minerals by the subsequent investigations of those who are engaged in the survey. I have myself visited several localities during the last year, and have analyzed some of the most important of our metallic substances, not previously examined, as will appear from the following notices.

Iron.

70. I omitted to mention in my report for 1837, that native iron had been found in this State. Although there has been some dispute concerning the occurrence of pure or metallic iron in nature, it is now generally admitted among the number of rare minerals. The United States have afforded some interesting examples of native iron which are undoubtedly of terrestrial origin; such are the specimens which have been found in Canaan, Conn. and in Guilford county, North Carolina. They differ from those masses which are supposed to be of meteoric origin, in being attached to some rock, or in being entirely destitute of nickel or chromium, which are constant ingredients of these meteoric stones.

In the museum of the Albany Institute is a specimen of native iron obtained from Burlington, in Otsego county, and presented by Prof. Hadley of Fairfield. The mass is evidently malleable and has the appearance of pure iron, although I am not aware that it has been chemically examined. Mr. T. G. Clemson has described a specimen of native iron found on the farm of William Rouse, in Penn-Yan, Yates county. The rocks at this place are sandstone, and the iron was found beneath and on the surface of the earth. It was of the colour and had the appearance of ordinary malleable iron. It was free from the oxides and acted upon the magnetic needle. It contained a minute portion of carbon, but neither nickel nor cobalt could be detected in it.*

71. As it regards the oxides of iron, from which all the iron manufactured in this State is obtained, the northern and southern sections seem to vie with each other in the extent and importance of their depositories. While at the north we have the immense beds of the magnetic oxide, at Newcomb, in Essex county, one of which is described by Mr. Hall as being more than a mile in length and upwards of five hundred feet in breadth, besides others of less magnitude in various parts of the same county, and in those of Clinton and Franklin, and the beds of specular iron in St. Lawrence;—we have at the south the vast deposits of magnetic oxide in Orange county, and of hematite in the county of Dutchess.

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* *Transactions of the Geological Society of Pennsylvania,* I. 358.

72. Several beds of magnetic iron ore have recently been opened in the county of Orange. Some of these I visited during the last year, and from the observations then made I have no doubt that when the direct communication with our great market is completed, the interior of the counties of Rockland and Orange will present a scene of activity and enterprise which will equal the most sanguine expectations. The revival of business has already had its effect upon the iron works now in operation, and it is not too much to predict that when the improvements recently introduced into the manufacture of iron shall have been perfected, this will become one of the great manufacturing districts of the State.

73. The following table will exhibit the composition of some of the iron ores recently analyzed.

	1.	2	3.	4.	5.	6.	7.	8.
Protoxide of iron,	42.26	....	....	44.10	....			
Peroxide of iron,	53.69	....	....	52.75	....	99.75	72.37	68.00
Protoxide and peroxide of iron,	....	95.75	96.50	....	98.90			
Silica,	....	....	....	....	....	0.25		
Silica and alumina,	4.05	4.25	3.50	3.15	1.10	....	15.43	6.50
Oxide of manganese,	....	....	....	trace.	....	....	....	8.50
Oxide of titanium,	....	....	....	trace.	trace.			
Water,	....	....	....	....	....	....	12.20	17.00
Sulphur,	....	....	....	....	trace.			
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

No. 1.—A specimen of magnetic iron ore which I received as from Fort-Ann, in Washington county. The precise locality I am not acquainted with.

No. 2. Magnetic iron ore from the O'Neil mine, Orange county. Compact, of an iron black colour, is attracted by the magnet, and possesses polarity. In the seams of this ore, small, but very brilliant, octahedral crystals are found. Cubic crystals of the same ore have also been found here, but they are of very rare occurrence.

No. 3.—From the Rich iron mine, Monroe, Orange county. The specimen is remarkable for the ease with which it cleaves in the direction of the primary octahedron. The cleavages have a high metallic lustre. Colour, iron black; powerful action on the magnet. The silica is undoubtedly foreign.

No. 4.—This ore is cellular, apparently having contained sulphuret of iron, which has been dissolved out. It looks like a decomposed ore, although it is not only attracted by the magnet, but possesses polarity. It sometimes contains thin seams of asbestus. It is from the Forshee mine, in Monroe, Orange county—a most interesting deposit of iron ores.

No. 5.—From the Wilk's or Clove mine, Monroe, Orange county. It consists of grains of magnetic ore, of various sizes, closely united; with grains of iron pyrites intermixed. The ore is attracted by the magnet, but does not possess polarity, or only feebly. The specimen analyzed was as free as possible from pyrites. The ore requires roasting before it is used by the smelter.

No. 6.—Specular iron ore from the town of Hermon, St. Lawrence county. Made up of black shining scales, resembling graphite. Magnetic action very feeble, or none. Powder, red or purple. This specimen is very pure,—but the ore sometimes contains an admixture of sulphate of barytes, and occasionally of phosphate of lime. It is now worked without difficulty.

No. 7.—Limonite or brown hematite, from Dungin's mine, in Richmond county. Small rounded masses united together by a ferruginous cement, constituting what is commonly called *shot ore*. Powder, brown.

No. 8.—A specimen from a stratum of brown earthy hydrate of iron, known by the name of *umber;*—associated with magnetic iron ore, at the Forshee mine in Orange county. There are several different varieties of iron ore at this locality.

In addition to the above, two artificial compounds of iron deserve to be noticed. The one is the *graphitic iron*, containing variable proportions of graphite and iron, from a rejected hearthstone of the Southfield furnace, in Orange county: The other, a silicate of iron, in crystals, from the works of the Messrs. Pierson at Ramapo, Rockland county. The latter contains, according to the analysis of Dr. Fisher,—protoxide of iron 70, and silica 30, in 100 parts.

MANGANESE.

74. The ore of this metal which is most common is that which from its colour is called the black oxide of manganese. It generally has a brownish black or iron black colour, an earthy appearance, and it is usually mixed with other substances, as silica, alumina, oxide of iron, and carbonate of lime. It is often friable, easily reducible to powder, and strongly soils the fingers; sometimes, however, it has a fibrous texture, the fibres radiating from a common centre.

From recent researches it appears that the variety known by the name of *wad*, differs in containing a portion of water, and it has received the chemical name of hydrated peroxide of manganese, although the varieties of this oxide are indiscriminately applied to the same uses in the arts. These are in the preparation of chlorine for bleaching, and in the manufacture of glass.

My report of last year contained a notice of a locality of wad occurring on Tug Hill, in Lewis county. Prof. Mather, in his report for the same year, describes several important localities of the same substance in the counties of Columbia and Dutchess; and he asserts that 50,000 tons of wad could be procured in these counties without any great expense. If carefully prepared it would be worth $20 a ton, or for the whole amount $1,000,000.

75. The following table will exhibit the composition of such specimens of wad as I have been able to obtain.

	1.	2.	3.	4.	5.	6.
Peroxide of manganese,	68.50	58.50	50.50	53.00	33.40	11.45
Peroxide of iron,	16.75	22.00	24.50	32.15	34.10	28.20
Earthy matters, (silica and alumina,)	3.25	2.50	4.50	6.90	8.75	44.75
Water,	11.50	17.00	20.50	6.85	24.00	15.60
Copper,	....	....	....	trace.		
	100.00	100.00	100.00	98.90	100.25	100.00

No. 1.—Specimen from the farm of Joseph Goodsell, two miles northwest of Hillsdale, Columbia county. Earthy, friable, of a blackish-brown colour.

No. 2.—From the farm of H. W. Gott, two miles west of Austerlitz, Columbia county. External characters similar to those of the preceding.

No. 3.—From the farm of David Parsons, three-quarters of a mile south of Canaan Centre, Columbia county. External characters similar to the former. The specific gravity of these is not above 3.

No. 4.—From Sing-Sing, in Westchester county. Colour blueish or brownish-black, compact. Specific gravity 4.33. Found only in small masses, in the Dolomite.

No. 5.—Found near Keeseville, in Essex county. Occurs in rounded masses, about the size of a pea, brown externally, and brownish-black in the centre; earthy, friable. It contains a large proportion of water and oxide of iron. Other specimens may be purer.

No. 6.—From Tug Hill, Lewis county. Colour jet black or brownish-black; earthy, friable. The only specimen I have at present, contains a very large proportion of impurities. Others will no doubt afford a greater amount of oxide of manganese.

Lead.

In my report for 1837, I gave an account of the lead mines, which had previously been opened in the counties of Columbia, Lewis and St. Lawrence. During the past season, I have visited some interesting localities of the sulphuret of lead, with other accompanying minerals, in the counties of Sullivan and Ulster, of which I shall now give a brief description.

76. The principal deposit of lead ore, in the county of Sullivan, is situated near the summit of the Shawangunk mountains, two miles northwest of the village of Wurtzboro', and three-quarters of a mile from the Hudson and Delaware canal. This mine is situated in the millstone grit of which this mountain is composed, and the ore appears to be in a bed, alternating with the strata, although its inclination is somewhat different. At the place where the lead ore was first observed, a perpendicular shaft has been sunk about thirty-eight feet in depth. At the time of my visit, the miners were engaged in constructing horizontal drifts or levels to intersect the deposit of ore below the present shaft. The first level is about fifty-two feet below the opening of the shaft.

The second is about 127 feet below the same point. In both these drifts, the ore has been reached.

77. Three varieties of galena, or sulphuret of lead, have been found at this locality, viz: the common, in the form of laminated masses, and breaking into cubical or rectangular fragments; the granular, composed of granular concretions, resembling grains of steel; and the compact, having a close and compact texture, made up of very fine grains, with a somewhat conchoidal fracture, and little metallic lustre.

The galena, in all its varieties, is associated with the sulphurets of copper, zinc, and iron; the whole being disseminated in a matrix of quartz, which occasionally presents beautiful crystalline forms. At the lower level, above mentioned, the galena and blende are in nodules of various sizes in the quartz—the galena sometimes appearing as a central nucleus surrounded by the blende.

78. The pyritous copper, when recently broken, is of a golden yellow colour, but its surface usually presents the bluish-black tarnish which often characterizes this ore. Sometimes it occurs in the form of small, though perfect tetrahedral chyrstals which have a high lustre. Imperfect dodecahedrons are also occasionally found, and sometimes these are covered with a greenish coating, which is probably a carbonate of copper.

79. The sulphuret of zinc is brown and massive, being every where intimately intermixed with the lead ore. Indeed, they sometimes pass into each other, by almost imperceptible gradations. This fact is of considerable importance in estimating the value of this ore, for the mixture of the blende operates very injuriously in the process of smelting.

From this description, it appears that the associates of the galena at this locality, are similar to those of the same ore found at Ancram, in Columbia county. Indeed, some specimens from the two localities can scarcely be distinguished from each other. The rocks, however, in which these minerals are imbedded, are widely different.

80. At the Sullivan mine, the deposit of galena, be it bed or vein, is three or four feet in thickness, but to make up this, there is a large proportion of quartz, together with the other minerals already enumerated. Several tons of lead ore have been raised from the shaft and levels; an extensive smelting house has been erected on the banks of the Hudson and Delaware canal, and mining operations have been conducted during the greater part of the season, on a scale which could have been

warranted only by the most sanguine expectations concerning the quantity and quality of the ore.

Whether these expectations are to be realized, will soon be determined. In the mean time, without expressing a decided opinion in regard to the final result of the enterprise, I deem it proper to state, that the large admixture of foreign minerals, renders the reduction of the lead extremely difficult. The processes necessary to overcome this difficulty may be so expensive as to be ruinous, even although the ore should be found in sufficient abundance.

On the other hand, it should be observed, that the situation of this mine is very eligible. Fuel, for the smelting process, can be obtained in the vicinity at a cheap rate, and the product can at once, and with great ease, be sent to market.

There are some other deposits of lead ore in the vicinity of that just described, but they are entirely similar in their character and associations. They have not, however, been wrought to any extent, and their examination at present, can throw no light upon the question, whether lead ore exists in this county in sufficient abundance and of sufficient purity to sustain extensive mining and smelting operations.

81. The ore from the Sullivan mine is in many instances, perfectly pure. One specimen which I analyzed, was entirely free from foreign matters, containing about 86.50 pure lead in 100 of the ore; but most frequently there is a large admixture of quartz, zinc, iron and copper. On the suggestion of Prof. Mather, that this ore contained silver, I repeated his process, and obtained a minute globule of that metal. The proportion which it bears to the ore I have not yet had an opportunity of determining. By cupellation, I have also detected silver in the ore from Rossie, in St. Lawrence county. The occurrence of silver in the lead ores, is not uncommon, nor is it ordinarily a matter of much importance, as the proportion of that metal is usually so small, that it is not worth the expense of separating it. But a process has recently been made public, by which, according to the inventor, those leads which are too poor in silver to admit of being advantageously subjected to cupellation, as it is ordinarily practised, may, by repeated fusions and crystallizations, be rendered so rich in silver, that cupellation can then be profitably employed.* The subject is of great importance to those who are interested in the lead mines of St. Lawrence county.

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* A detailed account of this process, with various statements, intended to show its importance to Great Britain, is contained in the abstract of the proceedings of the last meeting of the British Association for the Advancement of Science, published in the London Atheneum. It has been republished in the Family Magazine, and perhaps in other American periodicals.

82. The lead mines of Ulster county are situated in the same range of mountains which contain those of Sullivan; and only a few miles distant from the latter, mining operations have been conducted during the past year by the North American Coal and Mining Company. The principal mine is situated on the northwest face of the Shawangunk, about three-quarters of a mile from the Red Bridge, which forms the boundary between the counties of Ulster and Sullivan, on the Hudson and Delaware canal. The general character of the deposit of lead ore at this place is similar to that of the Sullivan mine, but in consequence, as it appeared to me, of some disturbance in the stratification, the rock and the bed of galena dip towards the north at a high angle. This, however, will hereafter be described by the geologist of the district. The mine has been worked by a perpendicular shaft, to which levels or drifts, passing into the mountain at different heights, are now constructing. The galena here, as at the Sullivan mine, is associated with copper pyrites and blende, in a gangue of quartz. The quartz often occurs in large and fine crystals;—these, however, are seldom doubly terminated, and are usually opaque.

At the time of my visit, the amount of lead ore obtained at this mine was quite inconsiderable, and it seemed to me that the prospect was far from being favorable to the proprietors. Perhaps, however, the mining operations were not then sufficiently advanced to enable me to form a correct opinion concerning the extent of this deposit of ore. But taking into consideration the nature of the rock in which the ore is found, the limited quantity of ore heretofore obtained, and the various foreign matters with which it is mixed, I more than doubt whether either of these mines will ever yield an amount of lead equal in value to the outlay which must be incurred in working them.

83. I have now examined and described, in my several annual reports, the principal deposits of lead ore which are at present known to exist in this State. A connected account of these will be introduced into the final work, with such additional information as may have been, in the mean time, obtained. It may be proper to add, that the lead mines of St. Lawrence county are the only ones which now give promise of successful exploration. The purity and abundance of the ore, and the ease with which it is reduced, all conspire to render these mines of the highest value and importance. No better evidence of the correctness of this assertion need be offered, than the fact that during the last year, (1838,) there were produced from the three mines in Rossie, 3,347,463

pounds of lead, which, estimated at five cents a pound, amounts to $167,373.15.*

TITANIUM.

84. The metal titanium was discovered in 1791, but its properties were not satisfactorily determined until the year 1822, when Dr. Wollaston found it in a slag at the bottom of a large smelting furnace in Wales. It has since been found at several other iron works in Great Britain. Dr. Emmons obtained this metal from the hearth stone of an iron furnace in St. Lawrence county, and I have detected it also in the slag of the Greenwood's furnace in Orange county. It usually occurs in the form of cubic crystals, which in colour and lustre resemble burnished copper. In my specimen there is also associated with the metal a coating of a beautiful purple colour, which may be the oxide of titanium, supposed to exist only in the rare mineral called *anatase.*

85. There is another oxide of titanium, now more correctly termed titanic acid, which exists in variable proportions in several of the ores of iron, and from the decomposition of which, during the smelting of these ores, the metallic titanium is obtained. This substance closely resembles silica in many of its characters, and when in considerable proportion, it is supposed to have an injurious effect upon the quality of the ore with which it is associated. In its pure or nearly pure form, it is used for the purpose of giving a yellowish tint to artificial teeth, and in consequence of its comparative scarcity, and the difficulty of its separation from other substances, is sold at a high price.

Of the titaniate of iron in the crystalline form, and now known by the name of Crichtonite, we have an interesting locality in Warwick, in Orange county, where it is imbedded in a dark coloured serpentine; and variable proportions of titanic acid are also contained in several of the iron ores of St. Lawrence, Jefferson and Orange counties.

ARSENIC.

86. Arsenical pyrites from which the compounds of arsenic used in the arts are obtained, has been found in this State, in the counties of Essex and Orange. In the former it is probably in considerable quantity.

87. There is a locality of arsenical minerals on the lands of Mr. B. Hopkins, near the village of Edenville, in Orange county, which is

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* *Report of the St. Lawrence rail-road committee, December,* 1838.

particularly deserving of notice. I visited it in company with Dr. Horton during the last summer, and with some difficulty we succeeded in obtaining specimens of considerable interest to the mineralogist. These are, arsenical pyrites of a silver white colour, occurring in a vein in the white limestone, and which I found to be composed of arsenic, sulphur and iron. Associated with this is the arseniate of iron, or cube ore, as it is called from the primary form of its crystal, which here occurs as a coating, and possesses a beautiful green colour and an adamantine lustre. Every where investing the two preceding minerals is a powder of a lemon yellow colour, which is ascertained to be the sulphuret of arsenic or native orpiment. In another part of the same vein is found a considerable quantity of the red oxide of iron, which, together with the sulphuret of arsenic, has undoubtedly been produced by the decomposition of the arsenical pyrites. And in addition to these metallic minerals, we have also arragonite in delicately radiated fibres, and of a snow white colour, and occasionally thin laminæ of transparent sulphate of lime or selenite. On the whole, this is one of our most interesting localities, not only on account of the minerals which it affords, but of the apt illustration which it presents, of the changes produced in the mineral kingdom through the influence of chemical agencies.

I have thus given a general view of the Mineralogy of the State of New-York, chiefly in reference to its application to the arts. My object has been to excite an interest in this subject among the great body of our citizens, and to satisfy them of the utility of the work in which I am now engaged; and if I have been at all successful, I shall feel greatly encouraged in carrying forward these investigations to their final completion.

I have the honor to be,
Your obd't serv't,
LEWIS C. BECK.

January 26th, 1839.

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OF THE

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SECOND ANNUAL REPORT

Of T. A. Conrad, on the Palæontological Department of the Survey.

The classification of the organic remains of New-York is approaching to a state sufficiently complete for an accurate grouping of the various strata. In Europe, the equivalents of the New-York formations are divided into two great systems, termed Cambrian and Silurian, which are unconformable to each other. The organic remains do not greatly differ in each, but they are far more rare and limited in number of species in the older, or Cambrian system (in this country,) except in the two overlying rocks, or the lowest of the Silurian system. Still in the fossils of the older division, we can recognize a character sufficiently marked and distinct, to enable us readily to classify the strata wherever we may find them in the most distant localities. The upper term of the Cambrian system may be recognized in the vertical and contorted slates and olive sandstones of the Hudson river, extending from Newburgh to Glen's Falls.

Organic remains, other than obscure Fucoids, are very rare, except in particular localities, where Fucoides serra, of Brongniart, abounds, and is very characteristic from its numbers, for in the Silurian rocks it is almost unknown. Several other species of the genus to which the serra belongs, have also been found in the same localities. The F. dentatus Brong. also occurs, but is not nearly so numerous as in the Silurian slates. This species has been referred to Graptolites Linn, and is supposed to bear no analogy to marine plants; indeed, all the members of the group are very unlike the true fucoids of the Transition. These are nearly all the organic remains which occur in the slates, but fragments of the trilobite, Cryptolithus tersellatus have been very rarely found, a species common in the Trenton limestone at Fonda, on the Mohawk, and at Glen's Falls. Over the highly inclined strata of the

Cambrian or Hudson system, rest in a nearly horizontal position the Silurian strata, with the limestones and slates of which series commenced the first condition of the seas, favorable to the existence of myriads of shells, corals, and trilobites, whose exuviæ have very materially added to the thickness of the strata.

In the report of the geologist of Pennsylvania, the olive sandstone of the Cambrian or Hudson strata, has been confounded with the fourth rock of the Silurian system, known by the name of Salmon river sandstone, which formation is admirably characterized in New-York, Pennsylvania and Ohio, by the Pterinea carinata of Goldfuss.

There is strange misunderstanding of the method of applying organic remains in the division of series of strata into formations, and the identification of widely separated rocks by the Zoological characters of each. In the January number of the New-York Review, the opinion is advanced, that the " Calymene Blumenbachii ought to be carefully sought for in the rocks which are said to correspond to the Dudley period. Unless it is found, or some other consideration is introduced, can it be believed that fossils are a satisfactory evidence of the age and place of rocks?" The line of demarkation between rocks of different age has never yet been drawn with any accuracy by the aid of Palæontology, except by the consideration of groups of species, one, or even a few species, having no weight whatever in the determination. Thus the shell termed Terebratula Schlotheimii, dates its existence with the Trenton limestone, and reappears in three of the latter formations of the Silurian system. Orthis testudenaria, Dalm. is peculiarly characteristic of the Trenton limestone, by its almost invariable presence and extreme abundance, and yet it is also found in the limestone of the Helderberg a formation of a far more recent origin. But, although a few species may have been continued through a succession of geological eras, the groups are widely distinct, and their value in determining the comparative age and identity of formations, can never again be called in question by a geologist who deserves the name.

Excepting two trilobites, I have always found the organic remains of the Dudley limestone to correspond with those of rocks far above the Trenton limestone, and therefore it was natural to suppose that the Calymene Blumenbachii had escaped from the catastrophe in remote seas, which destroyed it here. But that trilobite has lately been found in the Rochester shale, in company with Asaphus caudatas; in this place it occupies the same position in the scale of formations which it holds at

Dudley, above the Trenton limestone, but in this country it is characteristic only of the latter formation, for there it abounds, whilst in the Rochester shales it is very rare. Occasionally the relative position of two formations may be so obscured, or the mineral character so similar, that the amount of difference will not be always estimated by those who describe them. It is just so in Ohio and Kentucky, where no observer has yet drawn the line of distinction between the Trenton and the newer limestone superimposed upon it, because the similarity in mineral character and color is so perfect, and the formations thin out into mere seams and layers, that a critical knowledge of the fossils is necessary to determine the difference in age. It is possible, therefore, the Calymene Blumenbachii and Asaphus tuberculatus are most abundant in a limestone at the base of the Dudley series, which corresponds in age, not only with the Trenton limestone, but also with the Llandeile flags of Murchison, whose observations, when published more in detail than they have yet been given to the world, will probably clear up all this difficulty.

The catalogues of organic remains of the Silurian system, hitherto published in Europe, are only calculated to mislead and confound the geological enquirer, as they are far too vague; not only the species peculiar to certain formations being indiscriminately mingled, but even the groups of the Silurian and Carboniferous systems are strangely confounded. This is the case in "De la Bache's manual," "Thomson's outlines of Geology," Phillips' Treatise on Geology in the Encyclopedia Metropolitana, and in the Lethea Geognostica of Bronn. The last named author has published a plate of numerous species of organic remains as characteristic of the mountain limestone, among which it is difficult to detect one belonging to that system, for they are nearly all characteristic of the Silurian strata. There are also importanterrors in his figures, such as the round perforation in the beak of Atrypa prisca, an imperforate shell. Excepting Lingula, no bivalve with a *perforated apex* occurs either in the Silurian or Carboniferous systems. The genus Terabratula is wholly unknown, and the shells usually referred to that genus I propose to group under the generic name of Stenoscisma, derived from two Greek words signifying narrow fissure, a character these shells possess under the imperforate apex of the larger valve, and which serves to connect the genus with Delthyris, from which it differs in having no cardinal area. This last named character on the other hand connects it with the genus Strygocephalus. I refer to it the common Silurian bivalve, Terebratula Schlotheimii, (Von Buch.) The genus Producta of Sowerby is unknown in all the rocks of the Silurian system, except in the highest or the Ludlow strata, where two species occur; here on the contrary, the genus Strophomena of Rafinisque is unknown, as well as in the Carboniferous system, whilst it abounds in the Helderberg and Trenton limestones. The following table will show some of the characteristic genera of the two systems and subdivisions.

SILURIAN SYSTEM.	CARBONIFEROUS SYSTEM.
Brachiopoda.	*Brachiopoda.*
Strophomena, (lower and medial strata.)	Producta.
Crustacea.	*Crustacea.*
Dipleura, Eurypterus, (upper strata.)	Very rare, and the genera undetermined.
Platynotus, Trimerus, (medial strata.)	Polyparia?
Isotelus, Triarthrus, Ceraurus, (lower strata.)	Amplexus.
Polyparia.	
Catenipora, (medial strata.)	

Among the curious and interesting organic remains of the Transition, the fucoids are not the least worthy of notice, and they seem to have been much neglected by naturalists. They are even more characteristic than the testacea, so far as the species have been determined, for particular species are more absolutely limited to the respective rocks in which they originated. They assume a variety of forms, no doubt corresponding to various as yet undetermined genera. Some of them have been of a fibrous reticulated structure, having vescicular appendages, often lobed and imitating on the sandstones the forms of tracks of reptiles and birds which some writers have believed them to be. On plate 26, in Buckland's Bridgewater treatise, these foot shaped vesicular fucoids may be seen attached to the net-work, and no doubt they performed the office of floats to support the fibrous structure to which they were appended. Some naturalists have doubted the vegetable origin of these singular remains, but they could neither have been polyps nor radiated animals, since no trace of organic structure other than the mere general form is ever exhibited. Besides, like the Fuci, they were very partial to a sandy bottom, being comparatively rare in limestones, whilst the corals and radiated animals are chiefly found in the latter. Fucoides Harlani is extremely abundant in the red shales of Medina and Rochester, and in the equivalent sandstones and shales of Pennsylvania and Virginia, and is more generally known than any other species. It is absolutely limited to this peculiar formation, serving to identify it in every locality. It appears to have formed a net-work, like the Dictuolites, but terminating in some of its ramifications unlike the latter, in fasciculi, somewhat resembling the human fingers. It is very difficult to ascertain with certainty whether the branches really anastomose, but such is the opinion derived from a careful examination of some very perfect specimens.

It is doubtful whether a more perfect series of Transition strata than that of New-York can be found in any part of the world, and certainly no group or system is more perfectly characterized by peculiar forms of organic remains. Nine distinct groups occur within the limits of the State, all below the great coal formation and Carboniferous or mountain limestone strata, which lie in the bordering counties of Pennsylvania. To show the order of superposition of some of the transition rocks, and the distinctive nature of the organic remains, I have drawn up the following table, chiefly from observations made during the first year of the survey, and confirmed by subsequent examinations.

Table of formations, showing the order of superposition, and some characteristic fossils of the Transition strata.

10.	Carboniferous strata, (in Pennsylvania,)	Euomphalus catillus; Delthyris trigonalis, D. cuspidatus, Producta scotica, P. sulcata, P. scabricula, P. hemispherica, Goniatites minuta, G. Henslowi, calamopora polymorpha, Amplexus coralloides.
	ROCKS OF NEW-YORK.	
	Old Red Sandstone Group, (*Murchison.*)	
	Old Red Sandstone?	
9.	Olive sandstone, (organic remains undetermined, except a few land plants, very rare.)	
8.	Dark coloured shales,	Dipleura Dekayi, Cryphæus Boothii, Calymene Rowi, Pterinea fasciculata, P. concentrica, Posidonia lirata, Delthyris distans, (Sow.) Lima macroptera, Cyrtoceras maximum.
	Black slate,	Posidonia.
	Medial Silurian strata.	
7.	Gray Brachiopodous sandstone,	Atrypa elongata, Delthyris arenosa.
	Helderberg sandstones,	Fucoides cauda-galli.
	Helderberg limestones,	Asaphus micrurus, A. selenurus, Calymene bufo, Cryphæus calliteles, Calymene anchiops, Atrypa prisca, A. aspera, A. Wilsoni, Pileopsis tubifer, Strophomena rugosa, S. tuberulifera, Atrypa concentrica, Calamopora fibrosa, Cyathophyllum ceratites, C. helianthoides.
	Second Pentamerus limestone,	Pentamerus Knightii, Euomphalus profundus.

6.	Gypseous shales,	Eurypterus remipes.
	Rochester shales,	Asaphus caudatus, Platynotus Boltoni, Trimerus delphinocephalus, Orthis elegans, strophomena elliptica, Delthyris lineatus, Caryocrinus loricatus, C. ornatus.
	Pentamerus limestone,	Pentamerus elongatus, (P. oblongus?)
5.	Green slate, lenticular iron ore, &c.	Undetermined.
4.	Niagara sandstone, (red,)	Fucoides Harlani, Dictuolites Beckii, Lingula cuneata.

LOWER SILURIAN STRATA.

3.	Salmon river sandstone, (olive,)	Pterinea carinata, (Gold.) P. planulata, P. modiolaris, Cyrtolites ornatus.
	* Green slate,	Agnostis pisiformis.
2.	Gray crinoideal limestone,	Group of the Trenton limestone.
	Trenton limestone and slate,	Cryptolithus tesellatus, Triarthrus, Asaphus tuberculatus, Calymene Blumenbachii, Isotelus, Ceraurus, Orthis testudinaria, strophomena alternata, Pleurotomaria cirriformis, Orthoceras striatum, Trocholites ammonius, Columnaria sulcata, Trianisites, Fucoides dentatus, (Graptolites.)
	Mohawk limestone,	Orthostoma communis.
	Gray limestone with sparry veins,	Fucoides demissus.
	Gray calcareous sandstone,	Lingula acuminata.

CAMBRIAN SYSTEM, (*Sedgwick.*)

1.	Olive sandstone and slate,	Fucoides serra, (Brong.)
	Variegated sandstone, (Potsdam sandstone of Emmons,)	Dictuolites radians.

Primary.

Gneiss, &c.

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* The position of this rock with Agnostus was determined by Mr. Vanuxem.

Descriptions of new species of organic remains.

STROPHOMENA, *Raf.*

1. *S. eliptica.* Shell elliptical; inferior valve ventricose, gibbous in the middle, radiating striæ acute, remote; umbo elevated, ventricose, summit rounded; beak much incurved; superior valve striated; lateral extremities angulated, prominent. Length, ¾ inch. *Locality*, Rochester, in formation No. 6. See table.

2. *S. deltoidea.* Shell deltoid, with numerous radiating striœ and concentric rugose undulations, obsolete on the inferior half of the valves; inferior valve slightly convex above, gibbous, abruptly rounded and flattened at the base; striæ small and crowded; one or two lines in the middle of the valve larger and more prominent than the others; angles of the cardinal line slightly prominent. Length, 1 inch. *Locality*, Trenton-Falls.

3. *S. lineata.* Shell suboval, length greater than the height, inferior valve convex; lateral margins rounded, and forming, with the basal margin, a nearly regular arch. Length, ⅝ inch. *Locality*, Cayuga lake.

4. *S. carinata.* Shell suborbicular, with from 16 to 18 angular radiating ribs; superior valve with a sinus in the middle; inferior valve angulated in the middle, slightly flattened on the sides; base prominent and subangulated in the middle; basal margin sinuous. Length, ¾ inch. *Localities*, Helderberg mountain, in limestone; Ludlowville.

5. *S. modesta.* Shell alated, compressed, with obsolete radiating striæ; inferior valve slightly convex; extremeties of the cardinal line acutely angulated; within punctate. Length, ½ inch. *Locality*, Rochester, Mr. Hall.

Lingula.

1. *L. cuneata.* Shell cuneiform; lateral margins subrectilinear; beaks acute; valves convex towards the apex, flattened on the inferior half; base slightly arcuate. Length, ½ inch. *Locality*, Medina, Orleans co.

2. *L. acuminata.* Shell acute, acuminated at the apex; somewhat gibbous on the umbo and compressed laterally; basal margin rounded. Length, ⅓ inch. *Locality*, uncertain; in "calciferous sand rock."

3. *L. concentrica.* Shell ovate-acute, with very regular numerous concentric raised striæ; lateral margins subrectilinear in the middle. Length, ¾ inch. *Locality*, Helderberg mountain, in limestone.

4. *L. oblonga.*—Shell oblong, sides nearly straight and parallel, regularly arcuated above, and abruptly rounded at base. Length, ¾ inch. *Locality*, Martville, Cayuga county, in sandstone.

ATRYPA.

A. elongata. Shell narrow elliptical, with numerous radiating striæ; lateral margins truncated in the middle; inferior valve gibbous in the middle, and somewhat depressed on the sides. Length, 3 inches. *Locality*, Helderberg, in sandstone.

DELTHYRIS.

1. *D. acuminata.* Shell subcordate, dilated transversely; valves with radiating sulci; superior valve, very prominent and carinated in the middle, carina not sulcated, slightly arcuate in length; lateral extremities rounded; base emarginate; inferior valve profoundly bilobed, sulci not deeply impressed; beaks approximate. Length 2½ inches. *Locality.* Helderberg, in limestone. It resembles Atrypa acuminata, (Sow.)

2. *D. granulosa.* Shell trigonal, ventricose, with very numerous minute elevated punctæ; ribs numerous, convex, the interstices not deeply impressed; inferior valve bilobed; beak elevated, incurved, foramen large; superior valve with a wide medeal convex depressed rib, with a narrow groove down the middle; umbo prominent, summit rounded. Length 1¾ inches. *Locality:* uncertain, but belongs to the shales of No. 7.

3. *D. arenosa.* Shell trigonal, with radiating sulci; superior valve with a rounded elevation in the middle, having about 4 sulci upon it, or 5 ribs; inferior valve, with a corresponding furrow; basal margin undulated, prominent and angulated in the middle. Length 2¼ inches. *Locality.* Helderberg, in sandstone.

Fresh Water Shells.

CYCLOSTOMA.

C. pervetusta. Shell orbiculato-conical; volutions 3 or 4; base with a profound umbilicus, exhibiting the volutions to the apex. Length ⅓ inch.

PLANORBIS.

P. trilobatus. Shell orbicular, with three nearly equal rounded prominent lobes; the large volution rapidly enlarging towards the aperture. Length ¼ inch.

UNIO.

1. *U. primigenius.* Shell ovate, ventricose; anterior side narrowed, sinuous or contracted; posterior side profoundly dilated; dorsal margin elevated, rectilinear, subalated, beaks prominent, acute; posterior extremity rounded; cardinal teeth compressed, very oblique; lateral teeth lamellar, rectilinear. Length 1¼ inch.

2. *U. orthonotus.* Shell oblongo-ovate, slightly furrowed or contracted obliquely from beak to base; anterior side very short; posterior side elongated; dorsal margin rectilinear and declining; umbonial slope angulated; basal margin straight; cardinal teeth oblique. Length 1 inch.

These fresh water shells occur in the red sandstone at Medina, beneath the layers of Fucoides Harlani, the Unios and Planorbis not very common, but the cyclostoma in great abundance.

CRUSTACEA.

CRYPHÆUS, Green.

C. greenii. Body .... tail with the margin rather obtusely rounded; surface granulated; lobes obtuse or truncated at the extremity, end of the middle lobe somewhat expanded; groove on the ribs short and terminating abruptly in an angle.

Observations. When the crust of this trilobite is removed it exhibits very narrow prominent articulations, and no sudden depression at the termination of the ribs which is so marked a characteristic in the callitedes. I have named it in honor of Professor Green to whom we are indebted for the name and illustration of the genus. *Locality.* Moravia Cayuga county, in shale with Dipleura.

CALYMENE.

C. marginalis. Buckler with a broad margin; eyes large, semi-oval; middle lobe entire, convex, smooth, abdomen ....

Locality, near Ithaca, in a boulder. This has a much less prominent front than the Rowi, a deeper groove between the eye and middle lobe, and the tubercle which nearly joins the lower angle of the eye is much smaller.

T. A. CONRAD, *Palæontologist.*

Frankfort, Jan. 23, 1839.

To His Excellency W. H. Seward,
Governor of New-York.

SIR:—

I have the honor to enclose herewith my report on the First Geological District of New-York. It contains my report on the economical geology of New-York, Westchester, Putnam, Rockland and Orange counties, marked (A,) and an appendix in two parts marked (B) and (C.)

The document marked (B,) is on the descriptive geology of Orange county, by Dr. Horton; the other, marked (C,) is on that of New-York county, by Dr. Gale.

I have the honor to be,
Sir, your ob't serv't,
W. W. MATHER,
Geologist First District, New-York.

THIRD ANNUAL REPORT

Of W. W. Mather, Geologist of the First Geological District of the State of New-York.

To His Excellency William H. Seward,
Governor of the State of New-York.

Sir:—

As an introduction it may not be improper to state what progress has been made thus far in the Geological Survey of the First District of New-York.

During the first season, viz. in 1836, I completed the reconnoisance of the first district, and made the detailed surveys of Suffolk county, the economical results of which may be found in the first annual report. Assembly document No. 9, pp. 61, 96, 1836.

The second season was devoted to the detailed surveys of Queens, Kings, Richmond, Dutchess and Columbia counties. The economical results may be found in the second annual report, pp. 121, 184, Assembly document No. 200, 1838.

The third season, or 1838, has been devoted to investigating the geology of New-York, Westchester, Putnam, Rockland and Orange counties, the economical results of which will be found in the present report.

The *details* of geology that are not of *direct* practical utility, have been retained, with a view to their publication in the final report of the survey, since the sole object in making the annual reports, is to enable the people to profit by the discoveries made, while the survey is still in progress.

In addition to the geological investigations, a large collection of specimens has been made to illustrate the geology and mineralogy of those counties that have been examined. Specimens, corresponding nearly with the numbers given below, have been collected from the several counties, viz:

Suffolk, about	800
Queens, Kings, Richmond,	450
New-York, say	400*
Westchester,	712
Putnam,	423
Dutchess, Columbia,	1,352
Rockland,	465
Orange,	3,029
	7,631 specimens.

About one-third of this number has been collected for the geologists of the different districts, and mineralogist, so as to give to each a suite to illustrate the geology of the first district, leaving about 5,088 specimens, which are deposited in the State cases in the Geological Rooms of the first geological district. These cases are in the room over the State Library, (Miscellaneous Library.) They are all labelled and arranged in eight distinct sets. One of these sets is displayed in the glass show cases, while the seven duplicate sets are contained in seven horizontal layers of drawers, and placed in the same relative order of position as those in the show cases above.

The manuscript geological notes of my surveys in the form of a diary, are bound into nine duodecimo volumes of 400 to 700 pages each, each of which has a table of contents, and an alphabetical index to facilitate reference.

I have made topographical maps of Columbia and Dutchess counties, and partly completed the drawings of those of Putnam, Westchester, Rockland and Orange. Topographical maps had been published of the counties of Suffolk, Queens, Kings, Richmond and New-York, which rendered this labor for those counties unnecessary. Numerous local maps, diagrams, sections, &c. &c. are contained in the volumes of the diary.

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* The specimens from the island of New-York have not been received and placed in the cases, but it is supposed that there are about 400. Feb. 4, 1839. The New-York specimens are now in the cases. W. Horton.

During the next season it is my intention to make the detailed surveys of Ulster, Delaware, Greene, Schoharie and Schenectady counties.

This intimation of what counties it is contemplated to examine during the next season, is given at this time, in order that persons owning property in those counties and wishing examinations made, may give notice in due season. Letters, *post paid*, addressed to W. W. Mather, Geologist of the First District, Albany, and requesting him to examine the mineral resources of property in those counties, will be attended to in the course of the season.

In discussing the geology of the counties examined during the past year, we will consider first, that of New-York, Westchester and Putnam, and afterwards, that of Rockland and Orange counties.

The general geological features of these groups of counties, except the ranges of mountains called the Highlands, are widely different. Although I have spent twelve years of my life in the midst of the region explored the past season, and although in the habit of spending most of my leisure during that time in unravelling its complicated geological phenomena, I feel that I have but *begun* to develop those facts that are of high importance, not only in scientific, but in economical geology. The general geology is very simple, but when we come to examine particular strata, veins and beds of useful minerals, and trace out the connection of the different localities, it is found to require much time and an intimate practical knowledge of the subject. The strata, in many places, are transverse to the general direction of the strike of the rocks, in consequence of transverse upheaves, of which there are several striking examples. Again, faults are numerous, and in many of these the heaves are not only vertical but lateral, and sometimes to a distance of 1,000 to 6,000 feet. These counties present one of the finest fields in our country for the investigations of physical geology. A life-time might be well spent, and with advantage to the community from its economical results alone, in developing the geology of the counties explored this season. The time for the completion of the survey is so limited, that to do equal justice to all the counties, superficial and slight examinations only can be made. These, however, have been sufficient to develop a vast amount of mineral treasures that were unknown before or not appreciated.

New-York, Westchester and Putnam Counties.

General Remarks.

In their topographical character, these counties are hilly, with broken rocky ridges on the western side, while the aspect of the eastern is that of heavy undulating swells of land. The soil is derived from the disintegration of the contiguous rocks, and from the pebbles and boulders of materials transported from a greater or less distance from the NNW, by some natural cause. The soils resulting from such a variety of rocks, contain all the *mineral* elements of fertility, while the careful husbandman supplies artificially those *organic* elements which are necessary as food for plants.

Nature has deposited almost inexhaustible quantities of manure in the bog meadows of the interior, in the salt marshes along the coast, in the mud flats of the river, and in the limestone hills; while on the other hand, great quantities are annually taken from the city of New-York, and distributed over the country. This feeding of the soil, if it may be so termed, is as necessary to its productiveness as feeding our cattle and horses, if we would have them efficient. The mineral manures, as lime, gypsum, bone earth, &c. are the seasoning, while the animal and vegetable matter supplied to the soil are the proper food for the growth of plants.*

ECONOMICAL GEOLOGY OF NEW-YORK, WESTCHESTER, AND PUTNAM COUNTIES.

Fluviatile or River Alluvions.

These alluvions in the district under consideration are not extensive. The streams flow through a rocky region, from which there is little wash. The waters are limpid and pure, and little sediment is deposited from them, even in time of floods or freshets. There are no alluvions of this class of considerable extent in those counties that might not be classed with salt marshes. The Hudson river to Albany may be considered an estuary, in which the tide ebbs and flows, and the water is always brackish to the Highlands, and frequently as far as Poughkeepsie and Hudson. The most important of the fluviatile alluvions in the

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* Prof. Hitchcock, in his report of last year to the Legislature of Massachusetts on the geological re-survey of that State, has made many valuable and judicious remarks upon agriculture, upon soils and manures, and the office that these latter perform in supplying food to plants. The investigations of Prof. Hitchcock and Dana are considered the most important that have been brought before the public for a long time. They give a new aspect to agriculture as a science, and many facts that have been long known to intelligent and observing farmers, are there explained on philosophical principles. I would earnestly recommend that every farmer should peruse that part of Prof. Hitchcock's report of the geological re-survey of Massachusetts in 1838, which refers to agriculture, soils and manures.

Hudson in the counties under consideration, are the silt and mud banks forming in Tappan bay between Sing-Sing and Dobbs' ferry; the meadows near Gen. Van Cortland, at the mouth of the Croton river; the mud and silt banks extending from the above mentioned meadows to Teller's Point on one side and Sing-Sing on the other, and which occupy most of the bay between Teller's Point and Sing-Sing; the flats in Haverstraw bay between Teller's point and Verplanck; the meadows east of Verplanck; the flats between Verplanck and Royd Hook in Peekskill Bay; the meadows between Anthony's Nose and Marble Point, and the meadows and flats that lie SE, E, NE and N of Constitution Island, below Cold Springs. The last meadow is the only one that has been dyked out to prevent its being overflowed by the tides. Two or three hundred acres are enclosed, and good hay is produced upon these meadows. The meadow east of Verplanck may be said to be dyked out. A fine road has been built across the marsh near its south end within the last two years, and the tide may now be excluded. The amount of drainage water flowing into it is very trifling.

This meadow is filled with peat to a great depth. While the road was in progress of construction across this quaking bog, the weight of gravel was so great as to cause the turf to yield, and the road sunk, while a mass of peat was forced up on each side, rising above the general level of the marsh. Several thousand loads of gravel were necessary to fill the small portion of the road way that sunk, and it was estimated that the depth of the peat must have been about 40 feet. The peat seen at this place, and which had been raised above the surface by the sinking of the road-way, was of inferior quality, coarse and fibrous, but that which is good may be below. This marsh is so convenient to water transport, that the peat may be considered valuable.

Peat is probably abundant in the meadows near Constitution Island, though it has not been particularly examined.

The mud flats that have been mentioned in Tappan Bay, Haverstraw Bay, Peekskill Bay, and near Constitution Island, are all increasing slowly, and from a variety of causes, such as vegetable decomposition, the silt and mud deposited from the water, and the growth and decay of molluscous and other animals. They have increased more rapidly during the last twenty years than before, in consequence of the greater amount of cultivated land causing a greater amount of earthy materials to be transported by the rains and surface waters into the Hudson. These flats will eventually become meadows, but the time may be far distant. Should land continue to increase in value near the Hudson as it has for a few years past, it may become an object to dyke out several of these flats, and thus redeem some thousand acres. They are at present unproductive, except raising some oysters between Sing-Sing and Dobbs' Ferry. Oysters might probably be much more largely cultivated in the Hudson than they have been. On Long-Island, Staten-Island, and in New-Jersey, it is made a profitable business.

Salt Marshes.

The salt marshes, and the fluviatile alluvions of the Hudson river, in the counties of New-York, Westchester and Putnam, which may be classed as incipient salt marshes, have already been considered. The salt marshes of New-York and Westchester counties, on the coast, were alluded to in the Second Annual Report on the Geology of the First District, pp. 123, 125. The area of these marshes on the southeast coast of Westchester county, was estimated at 9 square miles, or 5,760 acres. The marshes of New-York county are described in the report of Prof. Gale, on the description of geology in that county, which will be found in the *appendix* to this report. The same remarks might be made on these marshes as to their origin, present and future uses, as were made on those described in the last year's report on Long and Staten-Islands.*

They may be made highly productive lands for tillage; they contain inexhaustible supplies of manure; many of them contain an abundance of peat, which may be used as fuel, or for making carbonate of soda; and the marshes may also be used for salt works where a large surface may be exposed either to solar evaporation, or to the frosts of winter, to concentrate the sea water and prepare it for crystallization.

Peat.

This combustible alluvion is not uncommon in the counties under consideration; but it is not so abundant as in Columbia, Dutchess and Orange counties. It is now coming into use as a fuel, and must, before many years, be extensively employed for this purpose in this part of the country, where coal and wood are so expensive. The manure peat of the salt marshes has already been alluded to. It may be estimated that there are 5 square miles of manure peat in the salt marshes of Westchester, or 3,200 acres, which will yield upon an average 1,000 cords of peat of the second quality to the acre, or in round numbers, 3,200,000 cords. The marshes of the Hudson river in New-York, Westchester and Putnam counties, that will yield peat, may be estimated at 1,000 acres, with a yield of 2,000 cords per acre, or 2,000,000 cords. These include those near Sing-Sing, Verplanck, Peeksville, Anthony's Nose, Constitution Island, and numerous smaller ones. The peat in most of these marshes where it was examined, is of inferior quality, fibrous, and contains much earthy matter. That formed in marshes in the interior of those counties is of much better quality, and far superior as an article of fuel. The following are the most valuable localities observed, though there may be many others of equal or greater importance. The rapidity with which it is necessary to traverse the country in order to complete the survey in the time authorized by law, renders it impossible to devote as much time and attention to local examinations as their importance, or the expectations of the people require. The geological survey, valuable as its results have already proved, can be called only a careful reconnoisance.

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* *Second Annual Report on the Geology of the First District of New-York, page* 124.

Peat.—Local Details.

	Cords.
On Joshua Raymond's farm, one-fourth of a mile west of Bedford, in Westchester county, Prof. Cassel's reports that there is a peat bog of 60 acres,................	60,000
Also on Abraham Underhill's farm, two and a half miles south of Crum Pond village, Westchester county, Prof. C. reports that there is a peat bog of 50 acres, averaging 20 feet in depth, and containing about.............	183,000
There was said to be a peat bog of 150 acres east of Croton, and about four miles southeast of Sumerstown Plains,....................................	150,00
A peat bog of 30 or 40 acres lies near the east side of Mahopack pond in Putnam county,...................	40,000
A large peat bog was observed near Patterson, Putnam county, and it probably contains..................	500,000
A peat bog of 6 or 8 acres was observed in Phillipston, on the Phillips estate, about two miles ENE of West Point, ...	10,000
Another on the same estate about eight miles from Cold Springs,on the turnpike road to Putnam C. H. may contain from 10 to 20 acres, ...	20,000
Another on the road from Putnam C. H. to Patterson, in Putnam county, containing about.................	20,000
Another four miles southeast of Pecksville, of 6 or 8 acres,	13,000
Another about one mile south of Scrub-Oak Plains, West chester county, say...............................	10,000
Carried forward,.................	

	Cords.
Brought forward,...............	
Another east of Stewart's iron mine at the base of the hill,	20,000
Another half a mile south of do. in Phillipston,........	10,000
Another near Davenport's corners, five miles northeast of Cold-Springs,...............................	100,000
Another half a mile west of Saxon Smith's, in the SSE part of Phillipston,..............................	25,000
	1,161,000

Marl.

This alluvion, although sought with care, was not found in New-York, Westchester or Putnam counties. It seems to be confined to the slate and graywacke regions of the First Geological District, as far as we can judge from the observations made thus far on the Geological Survey.

Terrains de Transport.

This, as a descriptive term, is meant to include all those materials which, as a mantle, cover the proper rock formations over a considerable area in the counties under consideration.

They bear undoubted evidences of having been transported by, and deposited from water. They are found as gravel and pebble beds, boulders and erratic blocks, and as sand and clay beds, in the main valleys of the streams. They are all of high scientific interest; but in the present report only those of economical value will be discussed.

Clays and Sands.

These materials form numerous and extensive beds along the banks of the Hudson, varying in elevation from the level of the river to a height of near 100 feet. The general order of superposition where all the beds occur, is as follows:

1. Gravel and pebble beds of variable thickness.
2. Sands stratified with water lines oblique to the strata.
3. Gray or yellowish clay.
4. Blue clay.

The blue clay generally rests on the subjacent rock, or on beds of gravel. The sand is extensively used for brick making, for lime-mortar, for casting sand and for moulding sand, and in brick making. Materials suitable for this purpose are found in many places, but the brick yards generally supply themselves from localities long used. The price paid for moulding sand is, in some places, 25 cents per bushel, so that a bank of it is of great value. It is composed of grains of quartz with some of feldspar, garnet, hornblende and magnetic oxide of iron. The water lines oblique to the strata, indicate the directions of the currents that deposited the beds and strata of this material. Near our cities and large towns, where much sand is required for mortar, the sand and gravel beds of this formation are of great value, and their proprietors realize a large amount per acre for materials that are usually considered almost worthless.

Clays.

Both the blue and gray clays are plastic and are used in the manufacture of bricks, stone ware and coarse pottery. Both these clays contain carbonate of lime, and they may without impropriety, be called marly clays, and are well adapted for use on light soils.

They will not only improve the texture of such soils, but they will supply some mineral substances which are necessary for the production of certain crops. They have already been used to some extent on such soils with advantage, and it is believed that they may be made more extensively useful as a mineral manure. The uses of these clays for stone ware and pottery, are scarcely worth mentioning as statistical facts, as the amount of industry, capital and production is so limited.

It is different with the brick manufacture, which employs a great amount of industry and capital. The gross number of bricks made in the counties under consideration, may be estimated at 42,900,000 per annum, with a value of $225,225, as the average sale prices at the kiln is about $5 to $5.50 per thousand.

Local Details of the Brick Manufacture.

There are three brick yards in Dutchess county, that ought to have been mentioned in the geological report of last year, but were omitted through mistake. One is located near Break-neck Hill, and two others are in operation near the mouth of Fish Kill creek. They make about 5,000,000 of bricks per annum. The estimated number of last year makes an aggregate of 17,000,000.

In Putnam county bricks are made as follows:

At the yard near Break neck Hill,	2,000,000
“ “ at the foot of Bull Hill,	1,200,000
	3,200,000

In Westchester county,

At Carpenter's yard below Peekskill,	7,000,000
“ the four yards east of Verplanck's,	5,000,000
“ H. I. Crugher's yard, southeast of Verplanck's,	500,000
“ Jesse Wood's yard, 2 miles above Teller's Point,	6,000,000
“ Anderson's, “ “ “	2,000,000
“ Frost & Doty's, “ “ “	5,000,000
“ Wager & Hull's, half “ “	2,000,000
“ Hull's, “ “ “	1,500,000
“ Yard on Teller's Point,	1,500,000
“ James and Samuel Wood's yard at Tarrytown,	5,500,000
“ Appleton's yard, 3 miles below Sing Sing,	500,000
“ Daniel C. Hardin's yard at Sparta,	1,200,000
“ Charles Smith's “ Sing-Sing,	500,000
“ Stephen Ford's yard, one mile above “	500,000
Total amount of bricks made in Westchester county,	38,700,000

There are several small brick yards that burn bricks occasionally, that have not been taken into account, but it is believed that all those making a regular business for shipments to New York and other places, have been mentioned. We may estimate the annual product of the clay beds in Putnam, Westchester and New-York counties, at 42,900,000 of bricks, which, at the average price of $5.50 per thousand, gives an income of $235,950 per annum.

The brick yard at Tarrytown has been in operation about 40 years, and was established by James Wood, the father of the present proprietors. He is said to have invented and patented the improvement in burning bricks by the use of anthracite. Five tons of the dust of anthracite coal is mixed with the clay for 100,000 bricks. For 450,000, which is about the usual size of the brick kilns, 22½ tons of coal are consumed in the bricks and 40 cords of wood in the arches.

This method is a great improvement over the former one, not only in expense but in saving time. Four days only are required to burn a kiln, while formerly fourteen to sixteen were necessary, where wood alone was employed, and the expense is reduced about three-fifths. The bricks being somewhat porous, permits the air to penetrate to the particles of anthracite diffused through their substance, and the heat is thus applied just where it is required, and without loss; and the wood is necessary merely to raise the temperature of the bricks to such a point that the anthracite shall begin to burn.

The principle involved in this improvement has been long in use in Europe; and in England their brick earth is required by law to be mixed with a certain proportion of the ashes of stone coal, which always contain much coke or half burnt coal, and which during the burning, performs the same office as the dust of anthracite, and makes hard burnt bricks. Many improvements have been made in the brick manufacture within a few years, and they are all in use in the brick yards on the Hudson river. The most important are those for grinding the clay, for moulding by machinery, and the one for burning that has already been mentioned. At Carpenter's yard, below Peekskill, the grinding and moulding are effected by steam power. The clay and sand banks in the clay and tertiary deposits along the banks of the Hudson, contain the elements of wealth and industry which will require a great length of time and the most favorable circumstance to exhaust.

ROCKS OF NEW-YORK, WESTCHESTER AND PUTNAM COUNTIES.

The rocks of these counties are numerous, many of them are applied to useful purposes, and they are every where abundant, and are seen cropping out from the surface of almost every hill and ravine. They will be discussed in the following order, viz:

1. Granite.
2. Gneiss.
3. Mica Slate.
4. Quartz Rock.
5. Talcose Slate.
6. Limestone.
7. Sienite.
8. Serpentine.
9. Steatite.
10. Augite Rock.
11. Greenstone.

The metalliferous and mineral contents of these rocks will then be described.

I. GRANITE.

This rock occurs abundantly in New-York, Westchester and Putnam counties.

It presents all varieties of texture, from a very coarse grained rock, to one almost perfectly compact. In colour it varies as much as in texture. It is white, red, gray, yellowish and bluish-gray, according to the colour of the minerals forming it. The colour of the feldspar usually determines that of the mass. It occurs in beds, in veins, in interstratified masses, and in knots, knobs, and protruding masses, in which no connection with veins or beds have been traced. The more common mode of its occurrence is in beds, 10 to 100 feet thick, interstratified with gneiss. Some of the granite is too coarse for use as a building material. Some is too compact and hard, being in fact, eurite; others are well adapted for building. Different localities show a great variety in strength, and in the ease or difficulty of dressing, as well as in the ease of quarrying and the magnitude of the blocks that can be procured. In the geological report of last year, it was mentioned that many places would undoubtedly be found in the Highlands, where fine quarries would be opened, and furnish "building materials of the best quality, and which would endure the changes of our variable climate for ages, without decay or disintegration." The investigations of the past season, have verified the prediction, that such localities might be found. The materials are of the best quality, easily quarried in large blocks, suitable for columns, cornices, &c. easily dressed, enduring as time, as the naked crags themselves will testify; and several of the localities, which were unknown to their owners, are so convenient to water transport that the blocks can be swung directly on board vessels in the Hudson, by means of cranes. When we consider the value attached to the quarries in Maine, Massachusetts and Connecticut, where, in most places, it is necessary to haul the stone, either on a common road, or construct a rail-way to navigable water, a distance from half a mile to six or seven miles, and observe that notwithstanding all these disadvantages, the great outlay of capital, and the distance to a market, that they make it a profitable business, we may begin to appreciate the importance of having inexhaustible quantities of materials, as good, as beautiful, as durable, and as easily quarried and dressed, on our own waters, within forty or sixty miles of the city of New-York, and so convenient to shipment, that no rail-roads and hauling are required. In order that the reader may be able to judge of the value attached to the quarries in Maine, I may be permitted to quote a portion of Dr. Jackson's Second Annual Report, on the Geology of Maine. "Many of the Maine quarries can furnish regular dimension stones, of excellent granite, on board ship, at $1.12 per ton, and the expense of transportation to New-York is rarely more than $2.50 per ton. Now there are but few cities where this article will not sell for at least $7 per ton, which will give a profit of $3.38 for each ton of granite.

" At the base of Mosquito mountain, beside a hugh pile of rocks that have fallen from the mountain's side and exposed a steep precipice of naked rock, the Frankfort Granite Company have begun extensive operations for obtaining building stones. Thus far they have wrought only those detached blocks, that lie in confused heaps at the base of the mountain, by which much expense is saved in quarrying.

" This quarry was first wrought in the month of May, 1836; since that time more than $50,000 worth of granite has been sold. It has been mostly sent to New-York, and is there used in constructing the Albany Exchange.

" A considerable sum, no less than $20,000, has been expended in digging a large sloop canal from the river to the base of the mountain, and that work must have consumed a considerable share of the proceeds from their sales; but when the work is complete, it will so favor the shipments as to make ample returns to the company.

" The whole mass of Musquito mountain is composed entirely of granite, and its height is 527 feet above high water mark, while the diameter of the mountain is at least twice the measure of its height, and it must contain at least five hundred millions of cubic feet, equal to 30,000,000 tons.

" Rough split granite sells for $5 per ton, of 14 cubic feet, on the wharf at Kennebunk port. The price remains uniform up to the dimensions of 26 cubic feet; and above that measure, two cents per foot is charged for every additional foot.

" Stones for store fronts, hammered, sell for 75 cents per superficial foot. Where two sides of a stone are fine dressed, and two rough hammered, three sides are charged, and nothing is demanded for the ends. Where three sides are fine dressed, and one rough hammered, they charge four sides and not for the ends."

LOCAL DETAILS OF GRANITE QUARRIES AND LOCATIONS SUITABLE FOR QUARRIES, IN PUTNAM AND WESTCHESTER COUNTIES.

Blunt's Quarry.

This is located on the south side of Break-neck Point, near the line between Putnam and Dutchess counties. There is an inexhaustible supply of a material of the best quality. It is a bluish-grey granitic rock, composed mostly of a dark coloured feldspar, with some hornblende, quartz, and occasionally a little mica. It is more properly sienite than granite. It is scarcely as dark as the Quincy granite or sienite, while it is as beautiful, has about the same strength, splits as well, and is as easily dressed. The stone from this quarry has been extensively used in the construction of the Delaware Breakwater, of Fort Calhoun and Fortress Monroe. The mountain rock has not been quarried at this place, but only the large masses that have tumbled from the cliffs above. It is not possible to give an accurate estimate of the quantity of granite in this vicinity, but there may be in the end of the mountain 500 acres, with an average depth of 500 feet, or 803,640 cubic yards to the acre, or 401,720,000 cubic yards on 500 acres. Blunt's quarry is located on the immediate shore of the Hudson river, but on account of the flats, the stone has been hauled about sixty rods to a landing. This quarry bids fair to become valuable; but there is one disadvantage that *may perhaps* operate as a draw-back to its advantageous position. It is overhung by a precipice of several hundred feet in height, and in the quarrying operations, the heavy blasts may bring down hundreds of thousands of tons of rock which can be useful only for dock stone and ballast.

HIGHLAND GRANITE COMPANY'S QUARRY.

This quarry is principally owned by Messrs. Howard & Holden. It is located one-fourth of a mile from the Hudson river, and half a mile east of Blunt's quarry, near Break-neck Point, and about two miles from Cold Springs. It is elevated about 400 feet above the Hudson, in full view of the river.

The stone is of excellent quality, and splits easily into large blocks. It is composed principally of feldspar, with a little hornblende, and is indistinctly stratified, or at least, it lies in thick, heavy beds, with parallel seams, six to twelve feet apart, and which are slightly inclined to the horizon. The quarry is inexhaustible, and ought to be very valuable. This quarry is on part of the bed of granitic rock, described under Blunt's quarry.

The stone is now hauled to the landing, about one-fourth of a mile, at an expense of 3 cents per cubic foot, or 42 cents per ton. Much of it is sent to Sing-Sing for the culverts and aqueduct bridges; and the freight to that place is 4 cents per foot, or 56 cents per ton. It is delivered at Sing-Sing in blocks of ten cubic feet and over, at 35 cents per cubic foot, or $5.90 per ton.

The dressing of this stone for the arches, is done at 14½ cents per superficial foot, and about two and a half superficial feet are dressed to the cubic foot, which make the stone dressed, ready for the arches, cost 70 cents per cubic foot, or $9.97½ per ton.

This quarry is capable of being worked at least 70 yards in depth, over an area of several acres; and allowing a profit of $1 per cubic yard, which is a low estimate, and 4,840 square yards to the acre, 50 yards in depth, ought in the course of working, to give a profit of $242,000 to the acre.

Stony Point, 1 *mile NW of Cold Springs*, *Putnam county.*—This is a rocky peninsula, stretching into the Hudson, about one-fourth of a mile. It is composed of gneissoid rocks, except the NW point of the peninsula, which is a granitic rock of the same character as that of Blunt's and the Highland Company's quarries. About two acres of this peninsula are covered by this rock, to an estimated mean depth of forty-five feet above high water mark, and it may be estimated that there are 145,200 cubic yards of granite capable of exploration on this point. It may apparently be split out in masses of any size, up to 100 tons or more, in regular blocks, and it lies immediately on the Hudson river, and with such a depth of water that large vessels may come immediately along side of the rocks to be quarried, so that the blocks may be swung on board with a crane.

Stony Point is owned by Mr. Philips of Philipstown, who was not aware of the existence of such a location for a granite quarry, until he was informed of it during the progress of the survey of Putnam county, during last summer.

PHILIPS' QUARRY.

This belongs to the same gentleman as the preceding. It is located on the Philips estate, about half a mile from the Hudson river, and one and a half miles ENE of West-Point. The rock is perfectly indestructible, and would be called granite by those who should see the blocks, without seeing the quarry. It is gneiss, in thick layers or plates, which have a slight inclination to the west, while the grain of the rock is nearly vertical. It splits easily, both in the direction of the grain and across it. It may be procured in the form of blocks of 5 to 10 or more feet square, and of the thickness of the plates of rock, which are from 1 to 4 feet thick. Some masses were seen which had been split off for columns, for store fronts, 12 to 14 feet long, by 1½, 1¾, and 2 feet square.

The rock at this quarry is of a light gray colour, almost white, and is a beautiful material for building. It is durable, of sufficient strength, easily dressed, and easily quarried, and the stone can be transported to the banks of the Hudson, for three to four cents per cubic foot.

The extent of this rock was not ascertained; but there is an area of at least 10 acres, with a mean depth of 60 feet, or 26,136,000 cubic feet, or 968,000 cubic yards of this granitic gneiss, or about 1,900,000 tons.

There is a location suitable for quarrying, in Putnam county, about three and a half miles below West-Point, and near the Cotton Rock.* The granite or granitic gneiss is of good quality, of a light gray colour and durable. This locality was not examined closely, but from the general aspect of the rock, it is believed to be a good location for a quarry.

There are two locations for fine granite quarries on the estate of Gen. Van Cortland, on the shore of the Hudson, in Westchester county, between Anthony's Nose and Peekskill. The granite has the appearance of stone of superior quality, perfectly indestructible, and has every external aspect of quarrying easily in large blocks. It is inexhaustible in quantity, and lies upon the shore of the Hudson river, with deep water along side, so that the facilities for shipment are almost unrivalled.

It is estimated that several millions of dollars are annually paid out of the city of New-York, and the towns on the Hudson river, for building stone, brought from beyond the limits of the State, while we have within our own boundaries and near the markets, inexhaustible supplies, of equally good quality, which can be quarried, shipped and hauled at less expense than the stone we now import from Maine, New-Hampshire, Massachusetts and Connecticut. The granites of the Hudson river *must* then, soon be wrought and sent to market, and the quarries will become very valuable.

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* The Cotton Rock is a noted place in the Highlands. It is on the shore of the Hudson, in Philipstown, between high and low water mark, about three and a half miles below West-Point. The rocks here are impure verd antique, (composed of limestone and serpentine, with brucite and other minerals imbedded,) serpentine, with diallage and veins of asbestus and delicate silky amianthus, diallage rock, augite rock, and granite. The amianthus which comes from the veins in the serpentine, has the appearance of cotton or of raw silk, and has given rise to the name "Cotton Rock."

II. GNEISS.

Gneiss is the predominant rock in New-York, Westchester and Putnam counties. It varies greatly in external aspect and in composition in different parts of the tract under investigation. Its colour is dependent upon the relative abundance of its constituents, which are variously coloured in different localities. The feldspar is white, reddish, or of a bluish gray; the mica is black, brown, yellow, copper coloured, and white; the quartz is white, gray or smoky. In some places mica abounds in the rock, and it approaches to mica slate, but more commonly the feldspar is most abundant, and gives character to the rock.

Much of the gneiss in the Highlands of the counties under consideration, is a hornblendic gneiss, in which the mica is wholly or in part replaced by hornblende.

A range of granitic gneiss, of a light colour, passes through Putnam and a part of Westchester county. It extends through Carmel, near Pine pond, by Mahopack pond, thence southwardly, and crosses the turnpike from Peekskill to Danbury. Another bed extends from Boyd's corners in Putnam county and crosses the Peekskill and Danbury turnpike about five or six miles from the former place. These beds are quarried to a small extent, for use in the vicinity; but they are too remote from water transport, for quarrying at present, for a more distant market. It is durable, of a light gray colour, easily split from the quarry, and easily dressed. If these strata reach the Hudson river, they are believed to have changed so much in aspect and quality as building stone, as not to have been recognized as the same beds. The bluish gneiss is quarried at Gen. Van Cortland's quarry, near Royd Hook, two miles west of Peekskill. Another quarry is opened near Peekskill Landing, half a mile northwest.

A range of reddish gneiss extends NNE from the point above Tarrytown. In many places excellent quarries may be opened, where the stone quarries well, dresses easily, and is beautiful and durable for architectural purposes. One quarry is already worked to some extent in this range, for the New-York market, on Mrs. Beekman's farm, about one and a half miles from Tarrytown. Large quantities of stone are taken from this quarry to be used in the construction of the culverts and bridges f the aqueduct that leads from the Croton river to supply New-York city with water.

Numerous other quarries have been opened along the line of the aqueduct, in the bed of gneiss just spoken of, and in others, to supply stone for this great work. It is not doubted that several of these quarries which lie near water transport, will be wrought for the New-York and other markets. Our citizens do not yet appreciate the prospective value of good quarries on the banks of the Hudson river.

Another range of gneiss, suitable in many places for quarrying, extends from near Manhattanville, on New-York island, by White Plains and so on NNE, probably into Connecticut, or Putnam county. It enters the valley of the Bronx river about eight or nine miles below White Plains, while it forms a part of the range of hills on the right bank of that, for several miles below.

At one locality in this range, the rock is quarried to some extent, to furnish the stone for the aqueduct bridge across Mill river, near Yonkers or Philipsburg. It is an excellent, beautiful stone, but rather hard to dress. This stone will last as long as it will be required to endure, and it seems indestructible.

A gneiss quarry has been opened two miles east of Yonkers, on the land of Elijah Valentine. The rock is of a superior quality, and is used in the construction of arches in the aqueduct. The proprietor receives a rent of 12½ cents per cubic yard for the stone.

The facts of scientific interest connected with the gneiss ranges, will be retained until the final report.

III. MICA SLATE.

This rock has a very limited distribution in New-York, Westchester and Putnam counties. Where it does occur, it seems to be a modification of gneiss, the mica becoming predominant, while within a short distance, the rock resumes its characters of gneiss. No locality was observed where there is prospect of valuable quarries of flagging stone, of this kind of rock being opened, near water transport. A locality of mica slate, well characterized and fissile, may be seen, forming a point in Haverstraw bay, half to one mile northwestwardly, from Henry I. Cruger's mansion. This rock assumes the characters of gneiss, two or three miles NNE of the point above referred to, and thence continues its course in the line of bearing of the strata.

IV. QUARTZ ROCK.

This rock is of small extent where it is visible; but from the localities where it has been seen being nearly in a line, it is believed that it forms a continuous stratum through a portion of Westchester and Ptnam counties. It is probably a continuation of the stratum described in the Second Annual Report, as forming a part of Peaked and Elbow mountains in Amenia and Dover, in Dutchess county, and as probably a continuation of that described by Prof. Hitchcock, in the west part of Massachusetts.* The granular quartz rock crops out on the bank of Peekskill bay of the Hudson river, about half a mile NW of Peekskill landing, near Hall's Point. The strata are nearly vertical, leaning a little to the WNW. It ranges up the "Peekskill Hollow." It is seen in connection with the iron ore, at Bradley's ore bed, in "Peekskill Hollow," about ten miles from Peekskill, and again it occurs near Boyd's corners, in Carmel, Putnam county. It is quarried to a small extent, near Boyd's corners, for door steps, hearth stones, and other purposes. It splits out in regular slabs, from 3 to 9 inches thick, and 3 to 7 or 8 feet square, with an uniform plane surface, and is admirably adapted for a flagging stone for streets, cellars, &c. Other locations may be indicated in the descriptive geology of the county; but only one was observed, where the stone was good for quarring for flag stones, near water transport.

This belongs to , of Peekskill. It is at the mouth of Peekskill creek, a little north of Hall's Point; and it is believed that a valuable quarry of flagging stones, of the granular quartz rock, may be opened at this place. The strata are nearly vertical, and the stones may be split off with great ease, if the quarry be opened in a proper manner. The flagging and curb stone used in New-York, and many other towns, are now brought from the Bolton and Haddam quarries, in Connecticut, and from the graywacke quarries in Greene county. Some of these stones, which are very beautiful, sell for fifty cents per square foot. The Bolton and Greene county stone, are carted from eight to sixteen miles over bad roads, and then shipped to a market. If stone, as beautiful and as durable, can be dug on the shore of the Hudson, where no cartage is required, and where the expense of quarrying is no greater than at the quarries mentioned, and where the business is now very lucrative, it follows, that such quarries on the shore of the Hudson would be very valuable.

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[*] Vide Second Annual Report on the Geological Survey of New-York, page 172. Vide Hitchcock's Geological Reports of Massachusetts, 1833, pages 22, 321.

V. TALCOSE SLATE.

This rock is limited in extent. It occurs in Westchester and Putnam counties, forming a range of hills several miles in length. It forms Blue Rock Point, on the post road, between the crossing of Peekskill creek and Annville. The slaty laminæ are parallel in direction to the limestone, and granular quartz rock on the east, which dip at an angle of from 75° to 85° to the ESE. This rock forms the principal mass of the hills to the NNE of Blue Rock Point for several miles. Gallows hill, a place celebrated during the Revolution, (in consequence of the public executions,) is a part of this range of rock. The rock is generally covered by soil, except where it has been denuded by water, or excavations for roads, &c. The soil is of good quality and produces fine crops. Farther northeast, this rock is rarely seen, but it passes up Peekskill hollow, and up a valley two or three miles west of Boyd's corners in Putnam county. It is very refractory in the fire, and is used for the in-walls of furnaces. Localities may, perhaps, be found, where slates for roofing may be quarried with advantage. The rock is very fissile, and splits in thin laminæ of some magnitude.

Diluvial scratches were observed on the out cropping edges, in many places, where the surface was exposed by uncovering the rock in making and repairing the roads. They are very distinct on the road that passes from Gen. Van Cortland's mansion over Gallows hill, on the western declivity. Like hundreds of similar localities observed last year in Columbia and Dutchess counties, the general direction is from north 20° to 30° west, to south 20° to 30° east. Veins of quartz were occasionally seen traversing the talcose slate. In some places, the quartz was loaded with pyrites, and where the slate had decayed and the masses of this mineral were scattered about on the ground, they had the spongy texture similar to the quartz from the veins and nests in the slates of Columbia and Dutchess counties. The cavities are also frequently filled with oxide of iron, like the quartz in the gold region of Virginia and North-Carolina. No gold was however seen, and it is hoped that a sufficient number of fruitless researches for *gold*, *silver* and *coal* have been made in this vicinity to deter others from future enterprises of such a nature, where the *expense is certain*, and the returns so very, *very uncertain*.

The talcose slate, at its junction with the gray and whitish limestones, is highly loaded with carbon and with pyrites. The one has given origin to the reports and stories of valuable coal beds in this region, and the other to the existence of gold and silver mines.

The slate and limestone glazed with anthracite, and presenting many points of resemblance to anthracite coal, are sufficient to excuse the conclusions of those who have supposed the existence of workable coal beds, and who did not know that such deposits have not been found in primitive rocks.

VI. LIMESTONE.

This rock is abundant, and extensively distributed in the counties of New-York, Westchester and Putnam. It is all associated with primitive rocks, such as gneiss, mica and talcose slates, and with granite, and is interstratified or embraced as beds in these rocks. In colour it varies through white, gray and clouded to black; in texture it is coarsely crystalline, granular, and perfectly compact: in composition, it varies from pure carbonate of lime to magnesian and ferromagnesian carbonate of lime, with variable quantities of earthy impurities: in hardness, from a very strong stone to one so friable as to be capable of being crushed to sand by pressure in the hand.

This rock is of greater present as well as prospective value in the region of country where it is found, than any other, unless it be the granite, which may, in progress of time, become equally valuable.

Limestone of New-York County.

This rock abounds in the north part of the island, and has been quarried to a considerable extent for marble, building stone, and for lime. The details of this rock in New-York county will be found in the descriptive geology of that county by Prof. Gale, in the appendix to this report.

Limestone of Westchester and Putnam Counties.

The limestone of these counties has the same dip and line of bearing as the contiguous gneiss and gneissoid rocks, and like them, is distinctly stratified. They all dip to the ESE, (as a general rule, but there are local exceptions,) at a high angle, varying from 45° to 90°. The limestone forms several nearly parallel ranges at intervals of to three or four miles apart, ranging in a NNE and SSW direction.

1st. The most eastwardly deposit of this kind, and of any great magnitude, is seen on Gouverneur Morris's farm, opposite Harlaem, where it is quarried for making the piers for the rail-road bridge and for other purposes. It is generally gray, and in some places is much intermixed with mica. Many of the blocks, and even the rocks in place in the quarries, have so much the aspect of gneiss, that close inspection is necessary to distinguish them. The limestone rock again appears in the bed of a small brook between Harlaem and West Farms village. It is thought probable that the West Farms and the Eastchester marble quarries are in this range of limestone, which passes up the valley of the Bronx river by White Plains and Rye pond, and so on further to the NNE.

2d. Another range passes from near Macomb's bridge in a NNE direction, is crossed by the aqueduct, and passes about two or two and a half miles west of White Plains.

3d. Another crosses from New-York Island at Kingsbridge, and thence ranges NNE, and forms the shore for some distance.

4th. Another ranges from Dobb's ferry in the same general direction by the county poor-house and Ackerman's iron mine.

5th. Another ranges NNE from Sparta, by Sing-Sing, about a mile east of Pine bridge across the Croton river. Some parts of this bed are pure white marble; some are dolomitic, and some have the aspect of gneiss, until closely examined.

6th. Another ranges from Verplanck's Point NNE to near Peekskill, where it changes its direction to the east. A mass of limestone, with a transverse line of bearing, viz. east and west, occurs near Henry J. Cruger's mansion, two and a half miles southeast of Verplanck's Point. It is supposed to be a displaced, outheaved mass frcm the preceding range.

7th. Another range extends up the valley of Peekskill creek from its mouth, and is a continuation of that in Rockland county, at Tompkins and Marks's quarries, associated with the same rocks.

There are many smaller bodies of limestone, some of which may be parts of the above beds, as there are several lines of transverse stratification, and lateral heaves and faults, that, in some places, render the tracing of the continuity of the beds a matter of much difficulty, and requiring more time than was at my disposal. These beds above described have not all been traced out continuously, and there may be some error in some of them, and there may be more beds than have been indicated, but these bodies are the principal ones.

LOCAL DETAILS OF THE LIMESTONE BEDS.

A small quarry is opened in the white limestone on the farm of Elijah Martin, two and a half miles WNW of White Plains. M. Cassels estimates its surface width at one-eighth of a mile. It is associated with mica slate.

The West Farms marble quarry is about one and a half miles from West Farms. Little is now done there, although the stone is of as good quality as is usual for this stone. 40,000 cubic feet of marble were quarried there in 1837. The proprietor receives 6¼ cents rent per cubic foot of marble raised. Some large blocks have been quarried, and from appearances more may be procured with little labor. The value of such quarries may be estimated from the rent received by the proprietor, which for 40,000 feet, the produce of last year, gives $2,500 for one year's rent. The excavation is small, and apparently the opening of the quarry is but commenced. The refuse stones of the quarry are burnt into lime for manure, with dust anthracite coal, which can be purchased at the coal yards in New-York for 75 cents per ton.

The Eastchester marble quarry is near the road from White Plains to New-York, and near the left bank of the Bronx river. The marble is white and crystalline, and is distinctly stratified, though some of the strata are several feet thick. The dip is about 80° westwardly. The strike north 32° east. It is worked by Kane and Morgan, and there are few quarries in the country more extensively worked. They sell about 60,000 to 70,000 cubic feet of marble per annum, a large portion of which is in large blocks from two to twenty tons weight, for columns and cornices of large buildings. The heavy blocks wrought into the forms required sell for from $4 to $5 per cubic foot. The smaller ones for $1 per foot. This quarry affords great facilities for obtaining large masses. At the time of my visit, they were quarrying a block 150 feet long, 8 feet thick and 7 feet broad. This was then to be blocked up into such sized and shaped masses as might be desired, and which can be done with little waste. It was estimated that this block would be worth $20,000. This quarry was opened in 1822, and has been more or less extensively worked to the present time. The marble is transported five to six miles, and then shipped to New-York and other places.

The Limestone of Bedford.

This was examined by Prof. Cassels. It is white and gray in different beds, crystalline, and not easy to crumble by the action of the weather, and Mr. C. thinks it adapted for use as a marble. It was opened a few years ago for making lime, and it is said to have made lime of good quality. This limestone locality belongs to a Mr. Frost.

The limestone of Cross Pond in Westchester county, was examined by Prof. Cassels. It alternates several times with gneiss in the breadth of one-fourth of a mile. He states the strike of the rock at N 30° E, and the dip at 80° westward.

Limestone interstratified with gneiss was also seen by Mr. C. on the banks of Long pond, and between Long and South ponds.

The strike of these beds is about north 70° east, and dip 60° eastwardly.

Good lime was made here twenty years ago, but the expense of wood has stopped the operations.

Limestone occurs at Bedford village, opposite the boarding school, where it was examined by Prof. Cassels.

Granular limestone occurs four miles northeast of Sing-Sing at Sarlis' Hotel, where it was observed by Prof. Cassels.

Limestone crops out on the hill ESE of Peekskill. It is much contorted and variously clouded, and some of it may, perhaps, be used for an ornamental marble. It also crops out near the lower dock at Peekskill, and is bounded on the east by hornblende rock.

A bed of limestone occurs five miles from Peekskill, on the road to Crum ponds. It is a dolomitic limestone that is used for marble, for making lime and for sand. For the latter purpose, the crumbling rock is crushed by a stone roller, and the mortar is said to set well in which it is used. Similar sand in some other parts of the country will *not* form a strong mortar.

Limestone of good quality occurs on Abra'm Miller's farm, on Mill creek, which is the outlet of Crum ponds. The locality is stated by Prof. Cassels, who examined it, to be five and a half miles southwest of Somerset plain, and three miles SSE of Crum Ponds village. The strike is north 30° east, and dip 75° eastwardly. Mr. Miller has made lime from the stone of his quarry for four years. He makes five kilns of lime per annum, each of 600 bushels, the average price of which is 50 cents per bushel at the kiln. Twenty cords of wood at $3 per cord, are used to a kiln, and six days are required for the burning. The limestone lies in high knobs, and can be easily opened on the northeast side, and Prof. Cassels thinks good marble may here be obtained. This locality is about two miles west of Whitlock village, through which it is supposed the New-York and Albany rail-road will pass.

Limestone was seen by Prof. Cassels on Plumb creek, about a mile west of Somerstown plains, on the Peekskill road. It occurs along the road for about half a mile.

Limestone occurs about two miles north of Phittlockville. It is also said to occur on Mr. Todd's farm, about a mile east of the locality above, where it has been used for making lime. Prof. Cassels saw it again about three-fourths of a mile south of the crossing of Titicus river. It is here abundant, and fine quarries might be opened. It crops out on the road side occasionally all the way to North Salem, where it is abundant and highly crystalline. A stratum of limestone was seen by Prof. Cassells about a mile north of Owenville, and again about a mile and a half west of Peach pond.

A marble quarry is opened nearly opposite Harlaem, in Westchester township, one-fourth of a mile north of Harlaem bridge. It is gray and white, and more or less mixed with mica. It is quarried for the piers of the rail-road bridge. The strike is north 25° to 30° east, and dip 80° WNW. It is associated with gneiss, with which it was seen in contact on the east side.

A bed of *dolomitic limestone* occurs near the county poor-house of Westchester county. It is called sandstone by the people, because it crumbles to sand by exposure to the weather. The same bed was seen at intervals to Dobbs' ferry. It crosses the valley of a small stream near the church on the hill at Dobbs' ferry. It forms the shore below Dobbs' ferry. A quarry is opened in this bed one-eighth of a mile from the shore of the Hudson, a mile below Dobbs' ferry, and a rail-road and wharf have been constructed to facilitate the transport and embarkation of the marble. Lime has been burnt from this stone on the shore, and some of the rock has been transported to New-York and burnt.

The *Sing-Sing marble quarries* are extensively wrought by the convicts of the State prison. Almost all of the limestone of these quarries crumbles by exposure to wet and frost, though it frequently requires many years to disintegrate. Near the surface the rock is perfect dolomite, covered by calcareous sand from the crumbling of the rock. At a greater depth the rock is sound, hard and tough. The bluish marble seems the most durable, though all crumble. Mr. Wiltse, the superintendent of the prison, informed me that the crumbling stone, when put into walls, became harder. This stone is extensively used for buildings, but in many instances it has already begun to crumble by exposure to the weather.

Lime is made from this limestone at the quarries, not only for consumption at the prison, but for sale. Large quantities of the stone are sold for the New-Jersey lime kilns, where it is burnt with dust anthracite coal for manure.

This stone is also used as a flux in the Cold-Spring furnace. For the above purposes of lime and flux, the stone is sold at the wharf at 37½ cents per ton.

Limstone lines the shore from Sing-Sing landing to Sparta landing, where its contact with granite is seen. The limestone here has the aspect of having been upturned, and its layers pitch down towards the granite. Augite, Asbestus, and other minerals are much intermixed with the limestone near the granite. The strata of limestone north of the prison are nearly vertical, and as distinctly stratified as gneiss. Crystallized pyrites, magnetic pyrites, and sometimes copper pyrites are found in particular layers of the rock.

The limestone beds pass under the town and must occupy a breadth of one-fourth of a mile.

A bed of limestone is opened on the hill northeast of Sparta. It is coarsely crystalline, and very beautiful. Small pieces of serpentine, and traces of iron and copper pyrites were observed very sparsely disseminated through the mass.

A bed of limestone is quarried for lime about 30 or 40 rods west of Hardy's hotel, at Verplanck. This stratum is bounded on the west by horneblende slate, and on the east by hornblende rock. This stratum crosses the road about three-fourths of a mile NNE of Hardy's hotel.

Limestone forms the shore at Verplanck landing, and skirts it for one mile to one and one-fourth miles up Peekskill bay.

Near Verplanck landing the limestone is much injected with veins of hornblende, so as to unfit it for making lime. This place is well worth the attention of geologists, as showing the intrusion of one rock into another. At a small distance north of the landing the limestone is free of hornblende, and is nearly a pure limestone making very good lime, and which is said to be equal to the Thomaston and Rhode-Island lime. As to the quantity of stone here accessible and adapted for lime, we may estimate the mean height above high water mark at 21 feet over an area of 50 to 80 acres, lining the shore of the bay nearly a mile in length. Each cubic yard of rock will make at least 4 barrels of lime, including the necessary waste. This would give about 135,000 barrels to the acre, or for 60 acres, 8,131,200 barrels of lime. Two kilns were burning as perpetual kilns at the time of my visit. They produce 25 barrels of lime per diem, with a consumption of one ton of anthracite coal.*

The expense of quarrying the stone is about 36 cents per cubic yard, or 9 cents per barrel.

The expense of coal is about 25 cents per barrel.

The lime was stated to be selling at New-York, at the time of my visit, for $1.50 per bbl. giving a profit after deducting every expense, including teams, attendance, freight, casks and cooperage, of 53 cents per barrel.

If we allow a nett profit of only 25 cents per bbl. an acre of this limestone of 21 feet thick, is capable of yielding a clear profit of $33,880.

Limestone was observed in two places between Verplanck and Henry I. Cruger's, by the upper road. One was near the church.

A bed of limestone of much economical importance occurs on H. I. Cruger's farm, about three miles southeast of Verplanck. It forms the shore half a mile east or southeast of Mr. C.'s mansion, and it extends eastward from the shore into the interior. Some of it is adapted for a marble, which may be obtained in blocks of considerable size on the shore. It is already quarried for lime, the stone for which is shipped to New-Jersey, where it is burnt for the New-York market and for manure, with dust anthracite coal at a small expense, and with a handsome profit. The stone is sold to the vessels at 37½ to 50 cents per ton on the shore where it is quarried.

This bed of limestone forms the shore of Haverstraw Bay for more than a mile, extending from the mouth of the brook near H. I. Cruger's saw-mill to the mouth of another small brook on Nicholas Cruger's farm.

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* This stone must be difficult to burn, or else the coal is not used to advantage, either from a defective form of the kiln, or bad management of the workmen.

Some estimate of the value of these limestone beds may be formed from the fact that the blocks can be swung on board sloops by means of cranes without any land transport, and that each acre may be made to yield from 100,000 to 500,000 barrels of lime, or for shipment; each acre will on an average yield about 100,000 tons of stone suitable for burning.

Limestone, variegated and clouded, occurs one-fourth of a mile south or southeast of Annville, across the marsh from the village near the mouth of Peekskill creek. It may, perhaps, be used for a marble, but in places it is intermixed with mineral substances which might be an injury to it in polishing and sawing. Its thickness could not be ascertained, as it was mostly covered by the tertiary formation that forms the high steep banks of 60 to 100 feet deep. Its range is NNE and SSW, and its dip about 70° to the ESE.

The same bed of limestone is again seen on the right bank of Peekskill creek, one-fourth of a mile above Blue-Rock Point. It is on land belonging to Gen. Van Courtland, and has been quarried to some extent. It is gray, bluish and variegated, in some places white, and makes good lime. Its range or strike is NNE, and its dip nearly vertical. On the west it is bounded by the talcose slate, and at the contact the rock is black, in some places glazed with anthracite, or a substance like it, and it is loaded with cubic crystals of iron pyrites.

This limestone reappears near Gen. Van Courtland's mill, one mile north of the locality just mentioned.

Limestone makes its appearance as knobs or hills, fifty to one hundred feet high, about two or three miles north of Annville, in the valley west of Gallows hill.

Limestone was observed about one and a half miles south of Putnam Court-House, on the farm of a Mr. Townsend, at two old mine holes, where some have supposed that silver, and others that marble was the object of exploration. It is scarcely necessary to add that no traces of silver ore could be distinguished. Both these excavations are in a bed of limestone about thirty rods apart. The bed is narrow, perhaps twenty feet wide, and is bounded by gneiss on each side; the strata are highly inclined to the east-southeast. Brucite and some coccolite were observed in the limestone of the northwardly excavation. At the other locality the limestone is very white, coarse grained, and contains imperfect crystals of phosphate of lime or green augite.

A bed of limestone containing brucite, serpentine and asbestus, is associated with the bed of magnetic oxide of iron on Mr. Tilly Foster's farm, two and a half miles southeast of Putnam Court-House.

Above Patterson in Putnam county, is an extensive bed of limestone. Many hundred acres in this valley are underlayed by limestone. It is quarried for lime, and forms a superior article. Sixty cords of wood are consumed in burning a kiln of 2,000 bushels. The price of this lime is 50 cents per bushel. Much of this stone seems well adapted for a building stone. Some of the rock contains beautiful tremolite.

A bed of impure limestone crosses the Cold Spring turnpike near Haight's tavern, in Phillipstown, five miles northeast of Cold spring; another bed is supposed to cross the road one-half mile north of Warren's tavern in Phillipstown; another bed crosses the road on the hill near Indian brook, between the Highland school and Warren's tavern; another near Mr. Ardens, two miles south-southeast of West Point; another near Philips' mill, one and a quarter miles east of West-Point; another at Cotton Rock, three miles south-southeast of West-Point; another still below, on the shore of the Hudson; two others on the shore, and a quarter of a mile east, near the old silver mine; another at the White mine on Anthony's Nose mountain; another three miles east-southeast of West-Point, near the Post road; another near Davenport's tavern, five miles northeast of Cold Spring; and another on Mr. Theodore Hustis' farm, one mile north-northeast of Davenport. All these localities are supposed to be in the same bed of limestone which is exposed in these various points, and probably in many others. Hustis' quarry is in the limestone bed above mentioned. Some parts of the hill are granular limestone, and a part is nearly compact magnesian limestone or miemite. Serpentine is frequently intermixed, forming a verd antique marble, which may, perhaps, at some future time be applied to use. Several fine minerals occur at this locality, which was discovered by Dr. Barratt in 1822. The precious serpentine of this locality is perhaps not surpassed in beauty by that of Newburyport or Easton, or even any locality known. It occurs crystallized distinctly with various modified forms. White coccolite, white augite, diopside, sahlite, phosphate of lime, amianthus, asbestus, pearl spar, pyrites, chromate of iron, magnetic oxide of iron, and various other minerals occur at this locality. The bed of limestone at this place forms a bed twenty to fifty feet thick, resting against granite or scinite on the west, while a stream flows at the base of the hill. It is difficult to determine whether it can be quarried with advantage, but it lies in nearly vertical strata on the steep face of the hill, at the foot of which, and within sixty yards, is a fine creek, with water power sufficient to saw a large quantity of the marble, if the demands of commerce should require it.

VII. SIENITE.

This rock abounds in some parts of Westchester and Putnam counties. In Westchester county it approaches in its characters to the "Quincy granite" of Massachusetts, and would probably make as beautiful and durable a material for building as that which is justly so celebrated. In Putnam the sienite is generally coarse grained, of a reddish colour, spotted with black crystalline and irregular masses of hornblende. This rock passes into hornblende slate and hornblende gneiss on the one hand, and into hornblende rock on the other. No localities were seen in Putnam county where this rock would be available for economical uses, except the granitic sienite, which has already been mentioned under the head of granite, as occuring in Break-neck mountain, and at Stoney Point above Cold Spring.*

The sienite of Westchester county is composed of feldspar of a dark grayish colour, containing a little black hornblende. It forms the shore of Peekskill bay of the Hudson river, from about one-half mile to one and a half miles below Peekskill, on the eastern side of the bay. It forms the mass of some of the hills for four or five miles southeast of Peekskill, and valuable quarries of this rock may be opened, if it can brought into notice and use. It is a durable and beautiful stone, and may be procured in large blocks, but it is more labor to dress it than many of the granites and sienites sent to market.

The same rock east of Verplanck, is changed to a black hornblende rock, with but little feldspar, and it contains magnetic oxide of iron disseminated in grains. One mile east of Verplanck it is coarsely crystalline and jet black. Beautiful specimens of hornblende may be obtained there. The jet black colour of this mineral has caused excavations to be made in these hills to find coal,† a search that every one who knows any thing of the associations of minerals with each other, would at once know was perfectly fruitless. The great weight of the hornblende has induced others to suppose that iron ore would be found here, which is possible, though no workable beds have been as yet discovered. In many places there is so much magnetic oxide of iron in the hornblende that the magnetic needle will not traverse freely in the vicinity of the beds. Where the hornblende is decomposed, a deep red soil is produced, coloured by the oxide of iron, and which is highly productive under judicious treatment.

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* The mountain at the northwest corner of Putnam county, is frequently called Anthony's Nose and Anthony's Face, in consequence of the profile bearing a rude resemblance to the human face, that may be seen in one position in passing it; but Break-neck mountain is the name by which it is generally known. Anthony's Nose mountain is at the southwest corner of Putnam county, opposite Fort Montgomery. Stony Point, above Cold Spring, I propose to call Quarry-Point, to distinguish it from Stony Point in Rockland county, a place of much notoriety in the annals of the revolution.

† Another excavation for coal was made near the landing at Peekskill. It was in gneiss in which there was a seam of plumbago, or black lead, mixed with pyrites. It would burn for a time, in consequence of the carbon and sulphur, but was not adapted for a combustable, even had there been an abundance of it. A great noise was made in the papers for a time, but the

Several quarries may probably be opened to advantage between the Hudson, Crom pond and Peekskill.

VIII. SERPENTINE ROCK.

This rock is found in several places in New-York, Westchester and Putnam counties, but no locality has been observed where it occupies an area exceeding 100 acres. Dr. Gale has described a locality on the island of New-York. A notice of it may be seen in his description of the Geology of New-York county, in the appendix to this report.—It is more or less mixed with steatite and a mineral that has been called anthophyllite. It is thought that blocks may be obtained suitable for ornamental architecture, but it is soft and easily scratched.*

Another locality of it may be seen on the peninsula east of New-Rochelle. It has been quarried to a small extent for a marble, but it is understood that good blocks, free from cracks, could not be procured. The serpentine at this locality shows almost every shade of colour and texture, from black to light yellowish gray, and from compact and crystalline to earthy. It is bounded by hornblendic rocks on the west, and by limestone more or less mixed with serpentine and with silicious matter on the east. Among the minerals noticed here, may be mentioned *verd antique*, *precious serpentine* of a red, green and yellow colour, *common serpentine*, green, yellow, gray, black, compact, granular and earthy; *jaspar*, *chalcedony*, *agate*, *drusy quartz*, *marmolite*, *hydrate of magnesia*, *carbonate of magnesia*, compact and crystalline; *tremolite*, *magnetic oxide of iron*, *and chromate of iron ?*

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miners soon lost the vein by sinking the shaft vertically, while the seam of plumbago followed the layers of the strata parallel to the dip.

* The term *marble* is at present restricted to those varieties of limestone that are capable of receiving a polish, and which are used for architectural purposes, but I think it would be well to include under this term some other substances that are, or may be used for ornamental architecture. Serpentine is one of these, and is called marble by those who have seen it polished, and did not know what it was.

The locality where the quarrying operations were carried on, was at high water mark, and they dug perhaps too near the level of low water. Good blocks of this rock could scarcely be expected free from cracks, where they had been exposed to the beating surf and the winter's frosts for ages. A large portion of the hill south of the beach, and of the locality at the southeast end of the beach, is composed of serpentine rock, and it is not impossible that quarries of some value may be opened there.

Another locality of serpentine rock, with radiating fibres of anthophyllite,? occurs in a southeasterly direction from White Plains three or four miles. I did not see it, but was informed of it, after I had left that part of the country. I had inferred the existence of such a locality from the boulders of this rock, which I saw scattered over the fields. Another locality is in Philipstown, Putnam county, about ten or eleven miles NNE of Peekskill, and about half or three quarters of a mile east of Horton's pond. The rock is of a blackish green, fine grained, and sometimes coarsely crystalline. It is yellowish on the weathered surfaces, and is associated with steatite. Ten to eleven acres seem to be underlaid by this rock, which might be quarried for an ornamental marble. It is about eight miles from water transport.

Another locality, one that has already attracted much notice, is Brown's quarry near Pine pond in Putnam county, four or five miles from Putnam Court-House, and one and a quarter miles NNW of the county poor-house. It is dark coloured, dark green to black, and from compact to a coarse crystalline, like coarse grained hornblende rock. It is granularly foliated like common white marble, polishes well, and is perfectly black when polished. It may be obtained in large blocks for sawing into slabs. Large blocks lie on the surface in Brown's lot, and the rock is seen in place all around the hill. In the mine lot adjacent, good blocks may probably be obtained by quarrying.

Twenty-five to thirty acres of ground are underlaid by this rock on the hill side, west of the brook, which is the outlet of Pine pond. It is easily accessible, and about 100 feet above the water level of the adjacent valley. Blocks of many tons weight can be easily procured; in fact many of this size are now lying on the surface, and require no blasting or splitting before they are put in the saw-mill. Magnetic oxide of iron, or chromate of iron, is disseminated through the serpentine in some parts of the serpentine bed, and this variety of the rock will not be suitable to work, as it can neither be sawed nor polished easily.

The quarry seems to be sufficient to supply the market, not only of our own country, but the world, with this kind of ornamental marble for a long time. It is really a beautiful material when polished, and it is hoped that it will be extensively used. I have seen no other locality where such a material can be obtained in so large blocks, sound and free from seams and cracks. A marble of this kind was used in ancient times in some of the old Spanish palaces, but it is exceedingly rare in Europe. Twenty acres of this rock belong to Mr Ferry H. Brown,* one acre to Mr. J. W. Brinkruff, and the remainder to Mr. Fary, as the agent of the Hudson River Mining Company.

IX. STEATITE.

This rock is rare in the counties under discussion. It occurs on the island of New-York at the serpentine bed, but it is believed not to be of good quality. It is there mixed with anthophyllite. Vide Dr. Gale's Report in the Appendix.

Another locality was seen this year near Peckville, a little north of the line of Putnam county, and within Dutchess county. It is there intermixed with serpentine, and although abundant, and quarried in large blocks, it was found difficult to saw it well, in consequence of the different degrees of hardness of the steatite and serpentine. It is beautifully spotted and clouded, and a steatite indurates by heat, it is possible that it may at some future time be wrought as an ornamental stone.

Some of the masses of steatite are very pure, soft and easily wrought. In some parts of the bed the rock is granular, or scaly talc, either pure, or traversed in every direction by crystals of actynolite.

Another locality was seen in Philipstown, Putnam county, on a Mr. McCabe's farm. It is near the serpentine rock before described as eight or nine miles NNE of Peekskill, and half to three-quarters of a mile east of Horton's pond. The rock here graduates through every variety of aspect, from talc, through steatite to serpentine. I did not see proper soapstone or steatite rock adapted for useful purposes, *in place*, but was assured that large blocks had been dug there, and that there was an abundance of it. I saw slaty steatitic rock *in place*, and small masses of beautiful steatite scattered over the ground. Good quarries of this rock are well known to be very valuable. The blocks are worth $20 per ton in market. This bed graduates on the east into serpentine rock.

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* Mr. Brown sold his twenty acres a day or two after I had examined the locality, and had informed him of its value, for $10,000. He had, a short time before offered it for sale for $100.

X. AUGITE ROCK.

This rock occurs in a great number of localities in Putnam county, and in a few in Westchester county.

It is sometimes intermixed with feldspar, but more commonly it is either by itself, or mixed with the various minerals that are usually associated with it. It occurs at most of the celebrated mineral localities in the Highlands. It is of all shades of colour, from white through gray and green of various shades to black, and from compact through various grades of granular to broad foliated masses, in the forms of fassaite, coccolite, common augite, sahlite, crystallized augite and diopside. The localities of this rock, and descriptions of the minerals associated with it, will be contained in the final report of the survey.

This rock has not been applied to any useful purpose.

XI. GREENSTONE.

Greenstone occurs in many places in Putnam, Westchester and New-York counties, forming dykes, which traverse the other rocks like veins, or it is interstratified with them. Like the augite rock, it will be discussed in the final report.

It has not been applied to any use in the counties under examination.

SILVER, LEAD, TIN, COPPER AND TITANIUM.

Several mines have been opened in Putnam and Westchester counties, under the expectation of obtaining silver. I have examined a great number of ancient diggings in Putnam, Orange and Westchester counties, where it is reported or imagined that silver has been, or is to be found; but I have seen no indications worth pursuing, or any ore that contained silver, unless in the copper and silver mines at Sing-Sing. These ores have not been analyzed, and it is not known that they even contain any silver, except from the common reports of the country that silver has been obtained from them.

Almost all of the diggings are in or contiguous to limestone. Many interesting mineral localities have been opened, and an abundance of crystallized minerals dug out, and prepared for the hand of the collector of these beautiful productions of nature.

It is, perhaps, superfluous to go into a detail of the numerous mining explorations in search of the precious metals in the Highlands; suffice it to say, that superstition and the mineral rod have been freely employed, and credulous persons have permitted themselves to be imposed on, and in some instances have expended their all, in explorations which any one versed in minerals and acquainted with their assoaiations, would have known from the beginning were hopelessly fruitless. Common pyrites and magnetic pyrites were repeatedly brought to me while I was stationed at the U. S. Military Academy, as an instructer of chemistry, mineralogy and geology, as specimens of gold ore, silver ore and tin ore, by the mine hunters, or by those who had been imposed on; and so fully were they persuaded that the mineral brought contained what they supposed, that no assurance without experiments would convince them. After examining mineral localities where lead and tin ores had been said to have been discovered, I have seen none in place, and have reason to believe that the specimens shown to me did not originate where they were said to have been found.

A piece of metallic antimony was shown to me during the last summer, and was said to have been found in Putnam county, but it had the peculiar foliated crystalline texture that is generally seen in that which has been melted, and which is different in aspect from the native antimony. While on this subject I will notice another fact that came under my observation. Coal was said to have been discovered in the primitive region of Putnam county. I was shown a lump of beautiful *Mauch-Chunk anthracite!!* which had been buried by some means unknown and dug up, and this was the evidence of the reported coal mine. It is hoped that our citizens will no longer suffer themselves to be duped by designing persons into mining speculations, most of which have a baseless foundation.

"The copper, silver and lead mine" of Sing-Sing is on the State farm, a little north of the State prison. It was worked before the revolution by a British officer in New-York. A shaft was sunk 150 feet, and a level run in the line of bearing of the strata from the bottom. It was drained a few years ago by a mining company, but was not worked. The mine is now filled with water, and its former productiveness is not known. For the above information I am indebted to Gen. Ward, of Sing-Sing. The mine is in limestone. No indications of silver or lead ore could be seen in the continuation of the stratum in which the mine had been opened. Gen. Van Courtland remembers the time when it was wrought, and when a boy was in the mines. There was a thin seam, he states, in which native silver was found. Several levels passed in different directions under the river. Gen. Van Courtland relates an anecdote of a gentleman at a dinner party, after the wine had circulated freely, giving £4,000 sterling for one-sixteenth of the proprietorship of the mine. The rock is an impure limestone containing augite and some magnetic sulphuret of iron, and when carefully tested by cupellation, gave no traces of silver.

Copper ore has been found in several places in Putnam and Westchester counties, but not in such quantities as to justify exploration.

Pyritous copper and green carbonate of copper are found in small quantities in the gneiss rocks at Phillips' mills, one mile and a quarter east of West-Point; also at Phillips' iron mine eight miles northeast of Cold-Spring landing. Pyritous copper, black sulphuret of copper, and green and blue carbonates of copper are found at Sparta, near Sing-Sing, and the surface indications were considered so favorable, that a mining company was formed, and chartered with a capital of $100,000. It was sold by the company for $1,000 to some persons in New-York, who incurred some expense in sinking a shaft and making an adit level from high water mark on the shore of the river to intersect the shaft. This adit level was to drain the mine as low as was practicable without the aid of machinery. Little ore was obtained, not enough, it is said by one of the old miners, to pay the expense of the candles used in driving the adit level. The ore is stated to contain some silver. A beautiful specimen of the ore was presented me for the State collection, by Mr. Cartwright, who discovered the mine and had the superintendence of it. The specimen is in the public cases in the geological rooms of the First District, in the capitol. Copper ore is found also in the marble quarries at Sing-Sing in a small vein. It occurs there as pyritous copper, black sulphuret of copper, and as the blue carbonate of copper. It occurs also in small quantities in the cliffs near the shore, about 100 yards southeast of the brick kiln at Sparta. It has also been found in small quantities in several places in the township of Mount-Pleasant, farther from the river. As it occurs in so many places in this vicinity in small strings and nests, it is not improbable that workable quantities of the ore may exist there, but I would advise persons to be cautious in investing capital for mining explorations. The working of metalliferous veins, with the exception of iron, has thus far in this country, been like a lottery, whether for gold, silver, lead or copper. There are some that have proved to be good investments, and have yielded permanent profits, but on an average, at least nine-tenths of them have cost far more than they have produced.

Titanium ore has been found in several places in Putnam county. At almost every locality where augite and scapolite are found associated, (and the localities are numerous) sphene or the silico-calcareous oxide of titanium is also found associated. Sphene, beautifully crystallized, was discovered by Dr. Barrett, at Cold Spring landing in 1822, during the excavations for the foundation of the long block of buildings next the shore, on the north side of the village. Specimens were obtained at that place in abundance by Dr. Barrett, and more beautiful than any that I have seen from any other part of the country. Titanium has, however, been applied to but one useful purpose, and that of comparatively trifling importance, viz: for tinging the enamel of artificial teeth of a slight yellowish colour, like the natural teeth.

ARSENICAL ORES.

Arsenical iron occurs in several places in Putnam county, but the only locality known in that county to which any practical importance is attached, is about four or five miles northwest from Putnam Court-House, and about half a mile southwest of Pine pond, in the township of Kent, near the serpentine marble quarry. This is one of the old mine holes from which silver is reported to have been obtained. The mine is now owned or leased by a mining company, called the Hudson River Mining Company. It had been cleaned out when I saw it The shaft is forty feet deep. Yellow pulverulent sulphuret of arsenic covered the sides of the shaft and the timbers, wherever they had been covered by water, resulting from the decomposition of the arsenical sulphuret of iron. This latter mineral abounds there. It forms a bed or mass in hornblendic gneiss rock above the shaft, and is there undergoing decomposition, forming arseniate of iron. The ore does not, so far as I could perceive, form a vein, but is a mass, and from the surface indications, and from what I saw in the mine, there is a probability of the existence of a great quantity of this ore. The mine goes by the name of the silver mine, and it is stated that silver has been obtained from it, but the individual who is said to have analyzed it, has no public name as a chemist, and until it shall be analyzed by a disinterested person of reputation as an analytical chemist, confidence ought not to be reposed in the statement that it is a silver ore. This kind of ore is wrought as a silver ore in Germany, where it contains some of the precious metal. It is possible this may also contain it, and even should it be argentiferous, it may not contain enough silver to make it worth separating.

The ore contains much arsenic, and it may perhaps be profitably wrought to furnish the common white arsenic of the shops. It is well known that large quantities of this material are consumed for various purposes in this country, such as the manufacture of shot, flint glass, medicinal preparations, &c. and the supply is at present derived from Germany. This mine would probably supply the demands of commerce in this country for a long time, if it should be thought expedient to work it.

A loose mass of arsenical sulphuret of iron, weighing 200 or 300 pounds, said to have been dug out of the road, was seen about three miles west of the mine above mentioned, and perhaps a mile from Boyd's Corners, in Kent.

IRON ORE.

Pyrites.

Magnetic and common pyrites are found in almost every part of Putnam, Westchester and New-York counties.

They are frequently found by persons who do not know what they are, but think them gold, silver, tin or lead ores. It is superfluous to enumerate in *this report* (which is devoted to economical results) the various localities where these minerals have been found, or the excavations that have been made in search of the precious metals. A few localities only were observed where there is a prospect that the sulphuret of iron may be economized. In one part of Philips' ore bed, near the summit of the mountain, the magnetic oxide of iron is so much intermixed with pyrites, that it cannot be used as an iron ore in the furnace. In some places, the sulphuret of iron seems to have been a paste, in which the grains of iron ore are disseminated, but in general, it is not so abundant; one-half to one-sixth of the ore may be said to be pyrites. By exposure to the weather, sulphate of iron or copperas is formed, and it might be made artificially from the ore in large quantities, if other parts of the bed of ore yield it as abundantly as that which I saw.

This ore, by long exposure, loses all of its sulphuret of iron by decomposition, and the rains wash away the sulphate as it is formed. The ore is thus purified, and fitted for the furnace. By slightly roasting the ore, the operation would be much more rapidly performed, and copperas easily made. Sixty pounds of pure bisulphuret of iron, mixed with thirty pounds of iron borings or scraps, will yield about 278 pounds of copperas.

In the valley of Patterson, Putnam county, two localities were seen where pyrites occur in some abundance disseminated in gneiss. The rock may, perhaps, be employed at some time in the manufacture of copperas. They are about 100 to 200 yards west of the junction of the gneiss with the limestone.

Another locality is on Jedediah Wood's farm, 6 miles SSE of Putnam Court-House, where it has long been supposed there was a lead mine. Pyrites are abundant in the gneiss rock near the eastern brow of the hill, and copperas effloresces on the face of the rock. Excavations have been made in two places where the pyrites abound, and the stratum was traced about 200 yards along the face of the hill. Some curious experiments have been made here with the magic glass and polished stones placed in the crown of a hat, in the way of mine hunting, by persons who seem to have been perfect dupes to their own believed power of discovering mines by this method: but they have found the people less credulous than themselves, and have not succeeded in discovering the pretended mines.

Another locality is a quarter of a mile east of Luddington's store, about six miles north of Putnam Court-House. The pyrites is in a gangue of hornblende. Copperas effloresces, and causes the rock to crumble to sand. It is in a small digging on the west side of the mill pond. Lead ore is said to have been found in the hill north, but no traces of it were discovered.

Many localities of pyrites were observed, which will be mentioned in the final report, under the head of mineral localities.

IRON ORE.

Limonite.

Limonite in small quantities, under the forms of compact brown oxide of iron, hematite and bog ore, occurs in many places in Putnam and Westchester counties. The loose masses scattered over the surface of the earth, seem to indicate important beds in Putnam county. If surface indications are worthy of notice, a bed of hematite and brown iron ore will probably be found in the hills near the county poor-house, in Putnam county.

A bed of limonite, containing some oxide of manganese, occurs very near the line between Philipstown and Carmel, in Peekskill hollow, about ten miles northeast of Peekskill. Its thickness is not known. Fifty to one hundred tons of the ore may be seen in heaps on the ground. The ore was dug many years ago, but it seems to be too silicious to work well alone in the furnace. By proper mixture with other ores, it might be wrought with advantage. Isaac Lockwood owns a part of the land underlaid by this ore. The right of digging the mine is vested in Nathaniel Bradley, of Conn. who purchased a large amount of mineral property in the Highlands some years ago.

The ore is associated with granular quartz on the east, and probably with limestone on the west, but this latter rock was not seen near the ore beds. These rocks are associated in the above order at the mouth of Peekskill creek.

A bed of hematite, of excellent quality, as far as the eye can judge, occurs on James Ackerman's farm, about one and a half miles north of the county poor-house, and four or five miles ENE of Tarrytown, in Westchester county: thirty tons of the ore were dug in 1837, and carried to the furnace at Cold Spring, Putnam county. It had not been used in September last, but it will undoubtedly make good iron. There is, probabably, an extensive bed of the ore. It is associated with white limestone, and this range of rock reaches the banks of the Hudson, a little below Dobbs' ferry. It is possible that beds of similar ore may be found connected with the limestone near the river. Should this be, the ore beds would be valuable, as there would be but little cartage to water transport. An acre of iron ore, only three feet thick, ought to yield the owner at least $4,000 if he leases it to those who dig it for fifty cents per ton.

Bog ore was seen on Judge Kemey's farm, one and a half miles south of Sing-Sing. It was about eight inches thick, but it seemed to occupy an area of only a few square rods, and in an economical point of view is scarcely worth notice. As a mineral, it is well characterized, and makes beautiful cabinet specimens.

Red ochre and *red chalk* occur on H. I. Cruger's farm, in Cortlandtown. It is presumed to be abundant from the appearances at the locality. It has been opened a little, by persons who wished to obtain small quantities of these materials. Specimens are deposited in the State collection.

Magnetic Oxide of Iron.

This ore abounds in Putnam county. Several mines are already wrought, and many more are capable of exploration They form masses in gneiss and hornblendic gneiss rocks, which, by casual examination would be called beds; but after a careful investigation of the facts, I think they may be called veins. Their course is parallel to the line of bearing of the strata, and they lie parallel to the layers of rock, but by close examination, it is found that in several instances, after continuing with this parallism for a certain distance, the ore crosses a stratum of rock, and then resumes its parallism, then crosses, obliquely, another, and so on. In other places, where a great bed of the ore occurs at some depth, only a few small stripes of ore penetrate through the superincumbent mass to the surface, as if the rocks had been cracked asunder, and these small seams of ore had been forced up from the main mass below. The beds or veins of magnetic iron ore lie either vertical, or dipping to the ESE, at an angle corresponding nearly to the dip of the strata. One example, only, was observed where its dip was to the WNW, viz: at the Stewart mine. The ore is very variable in quality. In some it is nearly pure magnetic oxide of iron; in others it is intermixed more or less with the materials of the contiguous rocks; in others, it is mingled with pyrites and with other minerals. Two main veins of this ore will be described under the names of the Philips vein and the Simewog vein. Numerous localities are known where this ore occurs, and where it has been dug in small quantities. They will be mentioned under the head of local details.

LOCAL DETAILS.

A bed of magnetic oxide of iron has been opened on Break-neck mountain, and several tons taken from it. The extent of the bed is not known, and the ore has not, it is believed, been smelted.

Another bed has been opened on the northeast part of Constitution Island, opposite the West-Point foundry.

Another was opened in the middle of the island. The ore occurs, disseminated in granite near the redoubt, above the Target rock on Constitution Island. Magnetic oxide of iron is thickly desseminated in limestone, near Philips' mill, one and a fourth miles east of West-Point; and it is found in that stratum of limestone in many places, from the above locality to near half a mile south of the "Cotton Rock," a distance of three miles.

It also occurs in the granite rock that is associated with the augite and limestone rocks near the old "silver mine"* three quarters of a mile southeast of Consook Island, and one mile northeast of Anthony's Nose mountain.

A bed was opened many years ago on Anthony's Nose mountain, but it contained much pyrites and crystallized phosphate of lime, both of which injure the ore for the manufacture of iron.

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* This mine was opened in ancient times, for what purpose is not known. Stalactites are found in the adit level, which is 200 yards long, and old tools with the handles rotted out have been found in it. It was reopened some years ago with the hope of getting silver—the man who worked it having been told that the scales of plumbago in the rock were sulphuret of silver. He is said to have spent all his property, and to have died in a mad-house.

The brown spar at the "White Mine," about one mile east of the western summit of Anthony's Nose, contains magnetic oxide of iron disseminated.

A locality of magnetic oxide of iron occurs on Mr. Tilly Foster's farm, two and a half miles southeast from Putnam Court House.

The ore forms a large part of a hill about one hundred yards long, ten to forty feet broad, and elevated twenty to thirty feet above the ground adjoining. Some hundreds, perhaps thousands of tons of ore can be easily procured at this place, without digging below the level of the hill.

Another ore bed was discovered some years ago about half a mile southwest of the preceding, on land belonging to the Misses Fowler. Some tons were dug out, but I do not know whether any has been smelted.

The Simewog vein passes through Simewog hill, and was traced one and a half miles SSW on Mr. Jedediah Wood's farm, and it is supposed to continue still farther SSW, as ore has been dug in that direction, about one mile SSW from Mr. Wood's house.

This vein was formerly extensively worked at Simewog hill, and the mine is called Townsend's mine.

This mine was the first known and first worked in this part of the country. The ore was carted to great distances and shipped on the North river, and some of the towns on Long Island Sound, to various parts of the country. The largest portion of the ore was carried to Danbury in Connecticut, and was there an article of traffic. It has not been wrought for twenty or thirty years, in consequence of other beds having been found in more convenient locations for smelting and transport. Fifty thousand tons of ore, at least, have been taken from this mine, estimating four tons to the cubic yard; and 100,000 tons more may probably be taken from the vein in Simewog hill, without going below the level of the small stream which flows across the ore bed. Should it ever be necessary to obtain this ore in quantity, (as is probable, from the prospect of the New-York and Albany rail-road passing up the valley on the east side of the hill,) at least 1,000,000 tons may be calculated on, above the water level of the Croton river, which flows along the base of the hill, and free from the expense of drainage, by driving an adit level from the level of the Croton, a distance of 300 or 400 yards to intersect the vein. This vein of ore has also been worked to the extent of several thousand tons, near the road, and north of the little stream mentioned above as crossing the vein. The vein here is from 8 to 14 feet thick, and nearly vertical in position, between strata of gneiss and hornblendic gneiss, which dip 70° to 85° to the ESE. On Simewog hill, one-fourth of a mile south, the vein, is from 3 to 20 feet thick, associated with similar rocks and with granite. It has been wrought on Simewog hill from 30 to 60 feet or more in depth over a length of 300 to 400 yards. It is scarcely doubted, from the observations made, that this vein is at least two miles in length, with an average width of 6 feet. Its depth cannot be estimated, but it is presumed that the labor of ages could not exhaust it in depth, as the bottoms of such veins have never, in any country, been found. In the estimates above, the calculation is based upon the vein being wrought down to the water level of the adjacent valley.

The Philips vein has been traced at short intervals for about eight miles, and is presumed to be continuous through this distance, except where it is interrupted by dykes and transverse heaves of the strata.—Many mines have been opened on this vein, and several of them are now worked.

The Cold spring and Patterson turnpike crosses this vein of iron ore near the crest of the mountain, about nine miles from Cold Spring landing. There is an opening near the road, and near this crossing, where some ore has been dug. Here the ore seems injected in little sheets, veins and beds through the gneiss rock, so as to form one-fourth to three-fourths of its mass through a horizontal thickness (as the strata are vertical) of 30 to 35 feet. Pyrites abound in a portion of the bed. The ore is easily traced along its course, as it shows itself distinctly along the line of bearing of the strata, disseminated, and forming black stripes in the rock. Near the house, one or two hundred yards farther SSW, another small opening has been made; 100 to 200 yards farther SSW on the line of the vein, a larger excavation has been made, and 500 to 800 tons of the ore thrown out, but it is here so much intermixed with pyrites as to be unfit for smelting, until the pyrites shall have decomposed. Some hundred yards farther SSW on the line of the vein, another opening has been made next the marsh, and is continued down the hill. The ore is here more or less intermixed with the rock, with a breadth of 10 to 20 feet, and the gneiss and hornblendic gneiss rocks associated, dip to the ESE at an angle of about 60°.

Farther down the hill are the two main openings, which go by the name of Philips' mine. The ore in some parts of the upper mine is more or less intermixed with copper pyrites, which injures the quality of the iron. The mine has been wrought badly, timbers being used to prop the overhanging rock, and great masses have crushed in and filled most of the mine.

The lower mine, where the whim is placed, has a solid rock roof, a part of the ore bed having been left in the top of the hill, while the mine has been worked below. The ore bed is here 15 to 20 feet wide, and has been wrought 30 to 40 feet in depth, over a length of — yards. The ore here is nearly a pure magnetic oxide of iron, and 20,000 to 30,000 tons of ore have probably been taken from these two mines.* Other openings have been made along the line of the vein for about half a mile farther to the SSW, and some 3,000 to 5,000 tons of ore probably removed. The rock in which this part of the vein thus far described, is contained, is mostly feldspar, with some bluish quartz.—Hornblende is also common. The feldspar is sometimes pearly in lustre and gray in colour, with wrinkled and bent faces, as if it had been soft and subjected to forces acting in different directions.

The next mine that is worked to any extent on this vein is the Stewart mine. It is about twelve feet thick of pure ore, and four feet more of lean ore. The former is much used in forges, the latter in the blast furnace. The ore at this mine is purer than that of any other mine I have seen, and is easily worked in the forge. It is granular, and easily broken and crumbled into grains about the size of BB shot, and is called by the miners "shot ore." The vein lies between strata of feldsparthic gneiss, which dip to the WNW about 70°. This mine is on the east side of the mountain crest, and about 100 to 200 feet above a marsh, with a steep declivity, and might easily be wrought to that depth without drainage, by driving an adit level to intersect the vein.

About half a mile SSW is another opening by the road side, where some ore has been dug, but it is lean, and much intermixed with the gneiss rock.

About three-fourths of a mile SSW of this is the Denney mine. It is about two and a half miles ENE of Warren's tavern in Philipstown, in a straight line, on one of the crests of the eastern ridge of the Highlands. The ore seems to have been injected among the rocks. In some places it forms regular stripes on the surface of the rock, parallel to the line of bearing, in others, there are scarcely any indications on the surface, while extensive masses exist a short distance below. This cap of rock over the ore is frequently called by the miners a rider, and the ore below, the horse. The mine now at work north of the house, is about 30 feet deep, and the vein of solid ore 25 feet wide, overlaid by a cap or rider of rock which contains but little ore.

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* *Green hornblende, actynolite, green hyalite, green and blue carbonate of copper, pyritous copper*, crystallized *magnetic oxide of iron* in the form of the acute rhomboid, *common pyrites*, and *acicular gypsum* (efflorescent,) were seen in small quantities at these mines.

Most of the ore is very compact and pure, but some contains hornblende. Much of the feldspathic rock contiguous to the vein is injected with thin veins of ore from one-eighth to one inch thick. 200 yards SSW is another opening from which much ore has been taken. This place has been excavated to a depth of 60 feet, and the vein is 20 to 30 feet wide. 20,000 to 30,000 tons of ore at least have been removed.

Contiguous to this opening is another 30 feet deep to the water, with a sheet of rock 5 or 6 feet thick, between two divisions of the vein. The rocks on each side of the vein are more or less injected with thin veins of ore; from examining the locality, many suppose that the ore has been injected into the cracks and crevices of the rock when broken up by some upheave.

This ore is delivered at the Cold Spring furnace, and at the wharf at Cold Spring, for $3 per ton, and mined as it is, scarcely any profit can be realized at this price. The quantity mined here is 600 tons per annum.

The Coal Grove mine is about one or one and a half miles SSW of the Denney mine. It is in gneiss. The vein is narrow at the surface, but at the depth of 12 feet it is 4 feet wide. The ore is of an excellent quality, very rich, and well adapted for the forge, and will, undoubtedly, make an excellent iron. The distance from this mine to the furnace and Cold Spring landing, is less than from the other mines.*

The Gouverneur mine is about one and a half miles SSW of the Coal Grove mine, and four miles east of the Philips manor house, at the southeast corner of the water lot. The ore is much intermixed in the rock, but would perhaps work well, mixed with other ores to flux out the feldspar and other minerals. It may probably be purer farther down. It has been opened in several places along the crest of the mountain to a depth from 3 to 12 feet.

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* The Kemble mine is a short distance NNE of the Coal Grove mine, and on Philips' vein.

A slight opening has been made about three-fourths of a mile NNE of the Gouverneur mine, between that and the Coal Grove mine. The ore is titaniferous and in lumps, and disseminated in the rock. The vein is 6 to 12 feet wide. It may perhaps be worked by picking the the ore, so as to separate the lumps from the gangue.

The mines and openings just described are the principal ones on the Philips vein, but the ore can be found along almost the whole line.*—It follows the crest of the east ridge of the Highlands a distance of at least eight miles. The breadth of this vein has been mentioned at different places from 3 to 30 feet wide. Its average is probably about 12 feet, and its length, as now known, about 14,000 yards. If the mean average of the vein be supposed to be half its bulk of ore, every cubic yard will contain about two tons of ore, and would yield at least one ton of iron, or each yard in depth would make 56,000 tons of iron. The vein, by proper working, can be mined to a mean depth of 100 yards, without expense of drainage, more than the proper opening of adits. We may place the workable produce of this vein above the water level of the adjacent valleys at 5,600,000 tons of iron.

The Cold Spring furnace is the only blast furnace in operation in the counties of New-York, Westchester and Putnam. It is supplied with magnetic oxide of iron from the Philips mine, the Denney mine in Putnam county, and from the Townsend mine in Canterbury, and the O'Neil mine in Warwick, Orange county. These ores are mixed in certain proportions and flux each other easily with a small addition of the Sing-Sing limestone. The produce of this furnace is from 1,000 to 1,400 tons of pig iron per annum.

Bonnel's forge in Philipstown is believed to be the only one in operation in the counties under consideration. It is supplied with the shot ore of the Stewart mine.

ECONOMICAL GEOLOGY OF ROCKLAND AND ORANGE COUNTIES.

General Remarks.

These counties may be classed under four divisions, each of which is distinct in aspect and agricultural features, as in its mineral products.

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* The phenomena of the mines in many places induce the idea of igneous injection, connected with a powerful upheaving force. The feldspar is often pearly, wrinkled, and with bent laminæ. The appearance of hyalite, a mineral usually associated with volcanic and trap rocks; the apparent injection in their veins among the seams and crevices of the rock; the appearance of the softening of the gneiss and bending its layers like a flowing slag, seem to point to an igneous origin of this vein. It often has the appearance of a bed, and at other times of a vein ramifying from a main mass between the strata, and at other times cutting obliquely across them, but still having its outcrop parallel to the line of bearing.

They are the mountainous region called the Highlands, and composed of primitive rocks; the slate and graywacke region of Orange county; the red sandstone and the trap rocks of Rockland county.

The tertiary and alluvial deposits might also be classed as two more divisions, but their area is not so great or their physical features so striking. *The Highlands in Rockland and Orange* are a continuation of those of Putnam and Westchester counties, and are similar in general aspect, in the kinds of rocks, and in their mineral products. The rocks consist of gneiss and hornblendic gneiss, granite, sienite, limestone, hornblende, serpentine, augite and trappean rocks. The strata dip to the southeast at angles from 50° to 90°, but there are localities where the strike and dip are transverse to the general directions. The strata are intersected by seams transverse to the direction of the strata, and nearly perpendicular to the line of bearing, and at intervals of 100 to 10,000 yards. Dislocations and vertical and lateral heaves have occurred along many of these lines of fracture. The outcropping edges of the strata are not parallel to the line of bearing, but like the ridges slope gradually down to the northeast, while on the southwest steep escarpments range along the lines of faults. Many of these faults are upon an enormous scale, and render the tracing of narrow beds of rock of economical value a matter of no small difficulty. There are no continuous ridges of mountains of more than a few miles in length, in consequence of the interruptions caused by dislocations and lateral heaves of masses of the strata. The hills of similar rocks succeed each other in echellon lines, which seem to have been caused by lateral heaves along the lines of fault. In consequence of this, neither the line of outcrop nor the line of bearing is parallel to the general direction of the Highlands, but ridge succeeds ridge, each of which runs out and diminishes in height until it disappears below the rocks, which are generally considered of more recent origin. For example, a traveller passing in Rockland county from southwest to northeast, along the base of any of the large hills of a mountain, if he continues his course without turning off to the east, around the point of a succeeding mountain, he will soon find himself in the midst of the Highlands. If he be travelling in the opposite direction along the base of one of the mountains, and continue his course, he will find himself receding farther and farther from the mountains as he passes each succeeding terminating hill. If he be travelling on the northwest flank of the mountains, the reverse will hold true, and progressing southwest from Cornwall, New-Windsor, or Newburgh, he will soon find himself entering the mountains and following through the valleys, will emerge on the southeast face of the Highlands. These valleys are called "cloves," and Smith's clove is a noted example. It is the one through which the New-York and Newburgh turnpike passes, without ascending more than a few hundred feet.

The Ramapo river flows through this to the south, while another stream, a branch of Murderer's creek, flows in the opposite direction. For local details on the rocks of the Highlands of Orange county, except those near the Hudson, the reader is referred to the descriptive geology of that county, by Dr. Wm. Horton, in the appendix to this report. The land of this region produces tolerable crops where it is capable of tillage. It is good grass land. The principal portions of the mountain region are used for growing timber and fire wood for the New-York market, for furnaces and forges.

The slate and graywacke region of Orange county is accurately described by Dr. Horton in the appendix to this report. In the general direction of dip, it corresponds with the primitive rocks of the Highlands, pitching to the southeast, and apparently passing under them.

The slate rocks lap around the terminating ridges of the primitive rocks of gneiss, granite, &c. and continue a greater or less distance up the valleys between the ridges, like water in the bays and re-enterings of a coast, but the dip of the strata, with the exception of some local contortions and transverse upheaves, continues parallel to the general directions of the lines of bearing and of dip. This is a rich agricultural region, celebrated for its fine grazing and grain farms.

The red sandstone region of Rockland county is a fine agricultural district. The land is in some parts much broken and stony, but in general it is rolling, with a rich sandy loam, resulting from the disintegration of the subjacent sandstone and its associated shales, marls and limestones. The strata are in general slightly inclined (1° to 3°) to the westward, but near the granitic rocks, near Grassy Point, they dip southwardly at a considerable angle, ranging from 15° to 45°. This rock occupies that portion of Rockland county from Grassy Point along the base of the Highlands to New-Jersey, and eastward to the Hudson river, but a portion of its area is covered over by trap rocks.

The trap region of Rockland occupies much less of the surface of this county than one would suppose in passing up the Hudson river. It forms a narrow belt along the shore of the Hudson, from the New-Jersey line, to near Haverstraw, where it ranges off to the northwest and then west, and finally southwest near the base of the Highlands, where it disappears. A branch of it strikes off about two miles north of Nyack in a westerly direction, and extends, with perhaps some interruptions, to near the Highlands. These ranges of trap rock are narrow, from one-fourth to one mile, and in some places perhaps one and a half to two miles broad. Along the Hudson, and on the north front of the range extending west from Haverstraw, the trap rock forms high mural columnar escarpments, of 300 to 800 feet in height, with a steep slope of debris, which have been crumbled off from the cliffs above by the action of the weather and the frost.* On the western and southern sides of this range, the trap rock generally slopes off more gradually, but in a few places it is precipitous. It can scarcely be considered otherwise than an enormous projecting trap dyke. Dykes were observed in several places cutting through the sandstone, some of which were very large. Occasionally it was seen spreading laterally from the dykes between the strata of sandstone. Many facts of high scientific interest were observed. They will be detailed in the final report on the Geological Survey of the State.

ALLUVIAL DEPOSITS.

Fluviatile Alluvions.

There are no alluvions of importance of this kind above water, that may not be classed as salt marshes. Tappan, Haverstraw and Peekskill bays are becoming more shoal by the deposition of alluvial matter in many places, and the larger steam-boats cannot go in to Dobbs' ferry, Tappan Slote, Nyack or Haverstraw, in consequence of the shoal water over these mud flats. There is a broad channel through these bays of considerable depth, but in many places the water is shoal nearer the shore, and large areas are becoming gradually more shallow, so that we may reasonably anticipate the time when they shall become land. The flats along the right bank of the Hudson, opposite West-Point, both below Gee's Point and near Camp-Town, have grown sensibly more shallow within the last fifteen years, during which time they have been under my observation. The same may be said of the flats between Constitution island and Gouverneur's landing, opposite West-Point, and between Constitution island and Cold-Spring.†

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* There are several places where valleys pass through the trap range above described, but it is believed there are none where this rock is discontinued. The valley west of Nyack is perhaps the lowest, but even here the trap is seen at the summit of the valley.

† In 1822, sloops used to come in at the foundry dock, about half way between Cold-Spring and the West-Point foundry, to take in their freight of cannon and other castings from the foundry, but the water has become so shoal that for some years past it has not been possible, and they now load at Cold-Spring.

Narrow flats extend along the shore in several places between West-Point and the base of Butler-Hill, and a broad one extends from near Cornwall to Newburgh. At New-Windsor, a long wharf is built out partly across the flats, but large sloops cannot land there except at flood tide. A few acres of pebbly alluvion have been formed at the mouths of two small streams that empty into the Hudson at Washington's valley, about one mile above West-Point.

Salt Marshes.

A salt marsh of several hundred acres extends from near the landing at Dobbs' ferry to near the long wharf at Tappan Slote. Large quantities of salt hay are made here every year.

Another salt marsh of 200 acres or more extends from Grassy-Point up the Sampsondale and Mimshecongo creeks to near Haverstraw.

Another small one is west of Stony Point in Rockland county.

Another of several hundred acres extends from about one mile south of Fort Montgomery, between Waggon's islands and the main land to within one mile of Dunderberg Point, near Caldwell's Landing in Rockland county.

Another occurs at the mouth of Murderer's creek, in Orange county, between Cornwall and New-Windsor.

These marshes all produce a fine crop of salt hay every year.

Peat.

Several of the salt marshes contain peat, but that which I saw is fibrous, and of inferior quality. That of finer texture and quality may probably be found at a depth of four or five feet. A moderate estimate of peat of second quality in these salt marshes, would be 500,000 cords.

A peat bog of about 40 acres was examined by Prof. Cassels, about one mile south of the Long clove, in Rockland county. It is on land of Isaac B. Van Houten. It is supposed to have a mean depth of six feet, and may be estimated to contain 40,000 cords.

Another is in the valley of the Hackensack river, about two miles west of Nyack, and contains about 50 acres with a mean depth of six feet, and may be calculated to contain 50,000 cords.

Peat, a few acres in extent, was observed by Prof. C. at the north end of Rockland lake,perhaps 5,000 cords.

Prof. C. reports a peat bog of 40 acres on land of John Snediker, one mile southwest of Snediker's landing, with an average depth of six feet of good peat, equal to 40,000 cords. This peat bog is wrought for the New-York market. It was opened during the last summer.

The proprietor receives	25	cents per	chaldron.
The cartage to dock, ...	37½	do	do.
Freight to New-York, ...	37½	do	do.
Expense of digging and curing,	50	do	do.
	$1.50		

This peat sells in New-York at $3 per chaldron, or $4.50 per cord, or $4,500 per acre.

Prof. C. observed a bog of 50 acres of peat between the lower village of Clarkstown and the Hackensack river. Its average depth is stated to be six feet, and will probably yield 50,000 cords. It is on lands of William O. Blines, Levi J. Gurnee and others.

Extensive peat bogs were observed on the mountain, near the turnpike from Haverstraw to Munroe works. One contains about 40 acres, another about 50 acres. These two bogs may be estimated at 100,000 cords.

Some other smaller bogs were seen containing 20,000 cords. Another was seen in the valley of Stony brook, containing 10,000 cords.

At the north end of Long pond, near the west line of Rockland county, a deposit of peat was observed. Its magnitude was not ascertained, but it may contain 10,000 cords.

A peat bog of about ten acres occurs about one mile southwest of Stony Point, and may be estimated at 10,000 cords.

Several small peat bogs were observed near Fort Montgomery, that in the aggregate may contain 10,000 cords. There is a small peat bog south of Fort Putnam, and near it; another southeast; another southwest; all within one-fourth of a mile. They may be estimated to contain 6,000 cords.*

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* Beneath the peat is a white substance that might be mistaken for marl, but that it will not effervesce. Prof. Bayley, of West-Point, has ascertained that it is composed of the silicious coats of microscopic infusiora. A similar substance has been seen in many of our peat bogs.

A peat meadow occurs on the mountain, half a mile west of Round pond, five miles southwest of West-Point, on land of Mr. Wilkins, and contains 10,000 cords.

A small peat bog was seen between the limestone ledge and Duck-Cedar pond, in Warwick, and may contain 4,000 cords. A peat bog was seen near the Patterson mine, containing probably 5,000 cords.

Another near the Crossway mine, containing 30,000 cords.

Another east of the Sterling mine, containing 50,000 cords.

Another, of 60 to 100 acres, was seen in the valley of Smith's clove, between Wike's and Galloway's. It contains probably 200,000 cords.

A peat bog lies west of Townsend's ore bed in Canterbury, and contains 10,000 cords.

In the slate and graywacke region of Orange county, peat is every where abundant, and the localities are so numerous that it would be tedious to enumerate them. The drowned lands, the Graycourt meadows and the Black meadows are the most extensive of these deposits. The former marsh is most extensive, and contains 17,000 acres. At a low estimate, there must be 25,000 acres of peat bogs in Orange and Rockland counties, that have not been estimated, and we may calculate, in round numbers, that they contain 25,000,000 cords of peat.

The aggregate cords of peat before enumerated, is 1,140,000 cords, and the total estimated amount of the peat in Orange and Rockland counties may be put at 26,140,000 cords, or about 72,000,000 chaldrons.

MARL.

No fresh water shell marl was observed in Rockland county: Dr. Horton found it abundantly in the peat bogs in the slate formation of Orange county, but the quantity has not been estimated, from the want of sufficient data. It is hoped that our farmers will make a proper trial of this material on their lands. The reader is referred to Dr. Horton's report on Orange county, in the appendix to this report, where the use of this material as a stimulant manure, is discussed.

TERTIARY DEPOSITS.

The tertiary deposits of Rockland and Orange are similar in composition, texture and superposition, to those of Putnam and Westchester counties, and which have been described. One of these deposits extends from Verdrietje Hook, below Haverstraw, to Stony Point; another lines the shore from Dunderberg Point, above Caldwell's Landing, to one and a half miles below; others of the pebbly and gravelly varieties, at an elevation from 100 to 200 feet above the river, overlaying the gneiss and granitic rock, extend at short intervals from Fort Montgomery to two miles above West-Point. A clay deposit lies in the valley, and near the shore between the Crow's Nest and Butter Hill mountains; and another extends from one mile west of Butter Hill Point, by Cornwall and New-Windsor, to Newburgh.

The tertiary deposits extend up the valleys of the streams, and are spread more or less extensively over the interior. They attain an elevation of 300 to 500 feet above the Hudson. Those on the banks of the Hudson are nearly uniform in height, and their surface is from 150 to 200 feet above tide water. Pottery of a coarse kind is made in Canterbury, and perhaps in some other towns in Orange county, but the principal econominical use of the clay beds of the tertiary deposits of Orange and Rockland counties, is for the manufacture of bricks. In Rockland county, bricks are made as follows:

At Hodge's yard, at Grassy Point,	they made in 1838,	...	2,500,000
Wm Holmes' do	do	...	2,000,000
Mumer's, do	do	...	3,500,000
Mackay's, at Haverstraw,	do	...	2,500,000
Churchill's, below Caldwell's Landing,	do	...	1,000,000
Lent's, do	do	...	500,000
			12,000,000

In Orange county, bricks are made as follows:

At F. Clark's yard, in Cornwall,	in 1838,	....	1,260,000
Cronkites, do	do	say	1,500,000
W. Stringham's, do	do	....	1,000,000
N. Audam's, do	do	....	3,000,000
M. L. Sproat's, Walkill,	do	....	300,000
S. C. Wood's, Goshen,	do	....	300,000
Norris', Newburgh,	do	....	2,100,000
Anderson's, do	do	....	300,000
Total bricks made in Orange county in 1838,		....	9,760,000

The sand of the tertiary is extensively used in the towns along the Hudson, in lime mortar, for walls, plastering, for laying pavements, and for brick making, and for moulding sand. For the latter use, it is worth 25 cents per bushel, and sand banks for these various uses on the banks of the Hudson, are valuable.

The gravel banks, also, when near the towns, are valuable, and yield a handsome revenue to their proprietors, for supplying earth for grading streets, filling, and for furnishing paving stones.

The soils of the tertiary formation in these counties are good, and yield abundant crops. The land lies well for cultivation, and is easily tilled. Gypsum has been extensively applied on these soils, and with the aid of good cultivation, has rendered them very productive. It is to be hoped that the marls which exist abundantly in this region, will be applied as a substitute. The marl of the ponds and marshes is nearly a pure carbonate of lime. Another, a clay marl, may be found almost every where in tertiary formation, underlying the pebble and sand beds. It is the same as the clay used in the manufacture of bricks. It contains lime, and would be a good dressing on light soils.

TRAP ROCKS.

The general distribution of these rocks, and their position as overlaying the red sandstone, and as cutting through its strata in dykes, have been mentioned. They vary much in mineralogical character, from coarse crystalline to a perfectly compact greenstone, and from a slaty clinkstone to a coarse amygdaloid. The steep escarpments along the shore of the Hudson present a rude columnar aspect, without having any regular columnar forms. These cliffs have long been called the Palissades—a name which most persons will acknowledge, is appropriate. Many facts of scientific interest were observed while examining these rocks. They will be detailed in the final report of the survey.

The soil overlying the trap rocks, where it is deep enough for cultivation, is rich and productive. The trap rock of the Palissades is extensively used in New-York as a docking stone, and for foundations. It is not quarried from the cliffs, but the masses that have tumbled from the cliffs above, and formed a slope of debris, are transported on slight rail-roads to vessels on the shore.

Jacob Voorhis has two of these quarries, from which he has shipped during the past season, about 100 sloop loads of 60 tons each, or 6,000 tons of stone.

Peter White has another near the two already mentioned, from which he has shipped this year 1,200 tons.

These localities are about two and a half miles north of Nyack.

The quantity shipped to New-York this year is only about one-fourth the usual quantity. The stone is sold at the quarries in cars, at 1s 3d per ton, and the boatmen roll the car to the vessel and empty it, and draw the car to the quarry again for another load. The stone sells in New-York for 4s per ton.

RED SANDSTONE.

The extent of this rock in Rockland county has been described. In colour, it varies from chocolate brown, through brick red and gray to white; in texture, it varies from pebbly conglomerate, through common sandstone, fissile and micacious sandstone, to shale; and in composition, from perfectly silicious, to an argillo-calcarious marl. Where the trappean rocks have cut through these various strata, or have spread laterally between them, their texture and appearance are much modified, and appear to have been subjected to the action of heat, which has partially melted them, or rendered them more compact and hard, like a hard burnt brick, or has made them metalliferous.*

The useful varieties of this rock are the *gray* and *red conglomerate* sandstone, which is used for the hearths of iron furnaces, and the red sandstone or *freestone* so extensively used for door steps, the corners of buildings, and for the caps and sills of windows and doors, in brick buildings. Strata of *red argillo-calcareous marl*, *dove-coloured* and *reddish variegated limestone*, and a *reddish calcareous* conglomerate or pudding stone, are associated as subordinate strata; and as they are useful, they will be discussed in order.

Red and Gray Conglomerate.

This rock is found in almost every part of the sandstone region, and many quarries of it have been opened for the purpose of supplying fire stone for the hearths of iron furnaces. This stone is shipped to various parts of the country for this purpose, and no stone is known superior to it for durability.

Isaac Van Houten's quarry is one and one-fourth of a mile north of the New City. This quarry is the first that was worked for obtaining furnace hearths, and was opened about fifty years ago. It has not been worked during the last thirty years until within a few months. Mr. Joseph Bird has reopened it, and pays Mr. Van Houten $10 rent for every set of furnace hearths he quarries.* The quarry is two and a half miles from the landing, and a set of stones for a furnace hearth delivered there, is worth $100. One stratum only is quarried for this purpose, and that is three feet thick. Another stratum above might be used, but it is stated to be too tender. This, and most of the quarries of sandstone were examined by Prof. Cassels. The stone is very porous, and filled with rounded quartz pebbles. It is tender when first quarried, but becomes harder by exposure to the weather. The furnace men prefer that the stones should "season" one year before they are put into the furnace.

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* Micaceous oxide of iron in small brilliant scales, is not uncommonly diffused through these strata, near their junction with trap.

Another quarry, owned by Mr. Cornelius Depew, is about half a mile north of Van Houten's. Here the stone is gray at the surface, but red two feet below, so that the blocks contain both colours. The stone is stronger, finer grained, and not so tender as Van Houten's, but in other respects similar. One stratum only is worked at this quarry. The grandson of Mr. Depew works this quarry, and pays $15 rent per set of blocks for a hearth. The hearths now in the Greenwood, Woodbury, and Cold Spring furnaces, are from this quarry.

Blauvelt's quarry, three miles northwest of the New City, is worked by Isaac Springstein. It is opened near the summit of the hill. The face exposed is about 20 feet high. The uppermost layer is 5 feet thick. The stone is soft and friable, and is used for furnace hearths, glass works, and for jambs. The proprietor receives $13.20 per set.

Another quarry has been opened three miles north of the New City by Richard Coe. It is the coarse gray sandstone, and near the junction of the trap and sandstone.

Another quarry, one-fourth of a mile west of Coe's quarry, has been opened by Levi Smith. This stone is also the gray sandstone from near its junction with the trap rock. A locality was observed on the shore two or two and a half miles below Haverstraw where the conglomerate looks like a good fire stone. The stratum is 4 or 5 feet thick.

Numerous quarries have been opened along the south base of the mountain on each side of the road, among which are those of John

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* A common hearth requires 14 blocks of stone, 10 of which contain each about 20 cubic feet, and 4 each about 10 cubic feet, or in the whole, 240 cubic feet.

Smith, Jacob Green and Jonas Conklin. It is not known how many sets of stones are obtained at these quarries, but the probable receipts are from $4,000 to $10,000 per annum.

Red Sandstone or Freestone.

This rock is extensively worked for cutstone, for flagging stone, and rough stone for basements along the shore of Tappan bay. The shore is skirted by quarries from two miles below Nyack to two miles above that place. Some of these quarries have been worked for more than fifty years.

Gesner's quarry is at the ship yard, about half a mile below Nyack. It is not much worked.

Westervelt's quarry is one mile north of Nyack. It was visited by Mr. Cassels. The flagging stone 1½ feet wide, and 2 to 3 inches thick, are delivered in New-York at 15 cents per foot. Rubble stone of this sandstone sells in New-York for 62½ cents per cart load of 15 cwt. The transport costs about one-fifth of this amount. The proprietors receive one-fifth of the proceeds of sales for rent from those who work the quarries. 2,000 feet of slabs besides rubble have been quarried this year. Clark's quarry is one and a half miles north of Nyack. Specimens of the sandstone of this and several other quarries are in the State collection.

Wilkin's quarry is one mile south of Nyack. 5,000 to 6,000 feet of slabs have been quarried here this year, and 500 cart loads of rubble stone.

The two quarries of Daniel Onderdonk and his brother are near each other below Nyack. 2,500 feet of slabs or flags have been quarried the past season from each.

Richard Clark's quarry is near Onderdonk's.

There are sixteen quarries in operation below, and fifteen above Nyack, within two miles from that place, which will average about 2,000 feet of slabs, (as Mr. Cassels was informed,) and 500 loads of rubble stones each, per annum.

This would give the product of the 31 quarries the last year as 62,000
feet of slabs, valued at.................... $9,300 00
and 15,500 cart loads of rubble, at......... 9,687 50
———— $18,987 50

It was stated that the annual amount of sales a few years ago, was nearly twenty times as much, and this falling off in the business of quarrying, has been caused by the general stagnation of business, consequent upon the embarrassment of the currency. This stone is good for many purposes, but it is not as durable or strong as many others, and is being gradually replaced in the market by stones which are harder to dress, but which will endure the vicissitudes of our changeable climate for a longer time.

Red Marl.

This material is found in many places in the red sandstone region. It seems to be a variety of the sandstone formation, where the materials are so fine as to form a shale, and where it contains calcareous matter.

It was observed in abundance in the high, precipitous banks of the Minishecongo creek, in Haverstraw, two miles west of Grassy Point, near Capt. De Camp's house. It may be used as a marl, for which it seems well adapted. It is interstratified with sandstone, shale and gray compact limestone, but gradually crumbles by exposure to the weather.

Compact Gray Limestone.

Strata of this rock, of a gray or reddish or dove colour, are interstratified with the red sandstone, shale and marl. The beds are from 1 to 6 or 8 feet thick, and some of the layers are 2 feet thick, of perfectly compact homogeneous limestone, which is admirably adapted for a building material. It burns to good lime, and some of it would make beautiful dove coloured and reddish variegated marbles. Blocks of this stone of a suitable size for sawing can be easily procured.

RED CONGLOMERATE LIMESTONE.

This rock occurs at or near the junction of the red sandstone formation with the primitive rocks. It is composed mostly of pebbles and angular fragments of gray and black limestone, (like the adjacent primary limestone,) mixed with pebbles of quartz, granite, gneiss, hornblende, sienite, &c. and all are cemented together by a reddish argillo-calcareous paste, mixed with gravel and sand of the various materials mentioned. Although examination was made to discover localities where this rock could be wrought as a marble, none could be found which did not contain an admixture of some other rocks than limestone. It contains fragments of rocks harder than limestone, which would render it difficult to saw and polish. In its general aspect it is similar to the Potomac marble.

It was seen on the road side west of Stony Point along the ravine of Minischecongo creek, above Captain De Camp's, three or four miles southwest of ladenton, and about half a mile west of Mechanicsville. It thus seems to skirt the northwest boundary of the sandstone formation in Rockland county, where it approaches the granitic and other rocks of the Highlands. A large block of this conglomerate is deposited in the geological rooms of the State collection in the capitol.

The *fossiliferous limestones* of Orange county at Mount Lookout, Triotite Mount, and Townsend's ore bed, with the *conglomerates*, *grits and shales* of Shawangunk and Bellevale mountains will be found described in Dr. Horton's description of Orange county, in the appendix to this report.

GRANITE.

This rock abounds in Rockland and Orange counties. It occurs in beds and veins, and in masses that are divided into layers several feet thick, and that might be called granitic gneiss, or thick bedded granite.

In the present report, the localities of economical interest as suitable locations for quarries will be mentioned. Numerous locations for this purpose are known at distances greater or less from the Hudson, and will be mentioned in the final report, together with many localities of this rock of scientific interest.

In the present report, those of economical value on or near the banks of the Hudson, and convenient to water transport, will be mentioned. Many facts connected with the granite of Orange county, will be found in the descriptive geology of Orange county, by Dr. Horton, in the appendix to this report.

Local Details.

Granite and granitic gneiss, suitable for quarrying, occur at the foot of Butter Hill and of the Crow's Nest.

A granite quarry might be opened with advantage on the shore, about one mile south of Fort Montgomery, and east of Mrs. Pell's house.

Several quarries can be opened on Waggon's islands, between Fort Montgomery and Caldwell's Landing.

One or more quarries can be opened at the foot of the Dunderberg mountain, between Caldwell's Landing and Waggon's islands.

These quarries may all be opened directly on the shore, and blocks of large size may apparently be quarried with ease, and swung directly on board vessels by means of cranes. Should these stones prove as good as their external aspect would seem to indicate, it would be difficult to estimate their value, which would be very great.

A valuable quarry may be opened on Stony Point, a little west of the light-house. This part of Stony Point next the United States' land, belongs to Mr. Brewster. There are about 10 acres of granite of good quality, and which may be worked to a mean depth of 60 feet to high water mark. This place ought to be able to furnish one million cubic yards of granite, or 27,000,000 cubic feet. This rock is the proper granite, composed of quartz, feldspar and mica. It is darker or as dark coloured as the Quincy stone; is as durable, and as easily dressed. This quarry ought in the course of working to yield a nett profit of $7,000,000, if the stone should prove as sound and easily quarried as its appearance would seem to indicate. The aggregate amount of workable granite in locations just described on the right bank of the Hudson in the Highlands, is estimated at 100,000,000 cubic yards, or 2,700,000,000 cubic feet, a quantity that may be considered inexhaustible.

GNEISS.

This rock is predominant in every part of the Highlands of Rockland and Orange counties. Its modifications have already been described, as well as its stratification, and allusion has been made to some of the transverse upheaves that have changed the dip and line of bearing, to a direction nearly perpendicular to the general ones.

This rock has been quarried in many places, but the quarries can scarcely be said to be fairly opened. Many fine locations for quarries exist which have not yet been opened.

Local Details.

Gneiss, and granitic gneiss, have been quarried from the loose blocks at the base of Butter Hill and of the Crow's Nest, on the shore. There is a great abundance of durable stone here, which can be easily obtained. It is rather hard to dress, but is beautiful and indestructible.

At West-Point two fine quarries of gneiss have been opened, and worked occasionally for many years. Most of the buildings at West-Point are constructed of stones from these quarries. They are of a beautiful bluish gray colour. The quarries are about half a mile north of Fort Putnam.

A quarry has been opened at Block-House Point, about half a mile below West-Point, or three-fourths of a mile below Gee's Point.

Another quarry may be opened about one-fourth of a mile above Block-House Point, on the shore, northeast of the Hospital.

Another quarry has been opened on the shore, about half way between Block-House Point and Mrs. Kingsley's. Much of the rock along the shore to near Mrs. Kingsley's landing, may be quarried with advantage.

Cozzens' quarry is one-fourth of a mile below Mrs. Kingsley's.

A quarry has been wrought on the shore, about one-fourth of a mile above Buttermilk falls.

Another extensive one might be opened between that and Buttermilk falls.

Another quarry is at Buttermilk falls.

Mearn's quarry is half a mile below the falls.

Two other quarries are within one mile below the falls.

Faurot's quarries are half a mile and one mile below Consook island. Capt. F. has sold 1,200 tons of stone in New-York this year at $1.75 per ton.

Another may be opened near Fort Montgomery.

Many other quarries might be opened along the shore at intermediate points, where the stone is of good quality; but much care is necessary in selecting judiciously, since a large portion of the mass of gneiss rock is not of a good quality. Little of the rock from Faurot's quarries to Mearn's quarry is good.

Several fine gneiss quarries might be opened on Waggon's islands, and between these and Caldwell's Landing.

TALCOSE SLATE.

This rock is seen on the shore of the Hudson, about one mile and a half or two miles below Caldwell's Landing. It passes on the west side of the limestone in which Tompkin's quarries are located, and crops out again in the bay beyond the first quarry, and is seen on the shore west of the second quarry. It continues to bound the limestone on the west until it finally disappears below the red sandstone formation near Capt. DeCamp's, two miles west of Grassy Point. It is a continuation of the bed of talcose slate described in Westchester and Putnam counties, as ranging from Blue-Rock Point, at the mouth of Peekskill creek, through Gallows Hill, and so on into Putnam county. It is adapted for use as a fine stone for the in-walls of furnaces, but is applied to no use at present.

At the junction of this rock with the limestone at the south end of the Tompkins upper quarry, the rock is loaded with carbon and pyrites. The slate is glazed with films of anthracite, and was supposed to be anthracite coal. Statements were made in the papers of the discovery of a coal mine, and the owner is stated to have been offered $5,000 for it but refused, in consequence of its supposed value.

Hornblende, Serpentine and Augite Rocks.

Hornblende rock forms the west part of Stony Point. It is intermixed with serpentine rock in some places, and in others it contains grains of magnetic oxide of iron. Diggings have been made here in search of iron ore, but no quantity of it has been found. Trap dykes cut through these rocks, and even penetrate the granite east of it, but not in such a way as to injure that rock for quarrying. Augite rocks occur in many places in Rockland and Orange counties, but it is not applied to any use. Black serpentine rock occurs near Forshee's mine in Orange county: it resembles that of Brown's quarry in Putnam county.

Limestone.

This rock occurs abundantly in Orange and Rockland counties. Those of Orange are highly important on account of their economical applications, and of much interest in consequence of the great number of beautifully crystallized and rare minerals that they contain. They are described in the descriptive geology of Orange county by Dr. Horton, in the appendix to this report.

The primary limestone of Rockland is not very extensive, but, from its location, it is of high economical importance. It skirts the shore of the Hudson for a mile or more, from the landing on the cove at the northwest point of Stony Point to a little north of Tompkins' most northern quarry. It extends thence to near Capt. De Camp's, two miles west of Grassy Point, where it disappears beneath the red sandstone formation. It occupies an area of some 400 to 600 acres, and much of it lies near to the water.

This stone is now quarried extensively on the banks of the Hudson at Tompkins' quarries. Mr. Tompkins purchased 20 acres of this land on the shore of the Hudson two years ago for 100 dollars per acre, which was thought an extravagant price. It is a ledge of limestone rock 75 to 100 feet high above high water mark, with deep water along side, so that vessels are loaded with great ease. The stratum at the new quarry is from 300 to 500 feet thick, (measured across the strata,) from the shore to its junction with the talcose slate rock. Many thousand tons of this stone are shipped annually to New-Jersey, where it is burnt into lime with dust anthracite at a small expense. The lime is in part used as a stimulant manure in New-Jersey, and part is barrelled and sent to the New-York market. Each acre of this limestone ought to to yield, in course of working down to water level, 600,000 barrels of lime, upon which a mean profit of 25 cents per barrel ought to be estimated. Most of this limestone is gray, but some is black and variegated, and might make a pretty marble.

The " marble quarry," as it is called, is on the banks of the Minishecongo creek, about two and a half miles west of Grassy Point. The most extravagant reports were circulated in relation to this quarry soon after its discovery.

The rock is composed of serpentine, chlorite, diallage, hornblende, limestone, and other substances, and is such a mixture of materials of different degrees of hardness that it could never be polished with advantage, even if it could be easily quarried.

A limestone quarry has been opened about three-fourths of a mile west of Capt. De Camp's, in Haverstraw, on land belonging to John Brooks. Much of the stone is white, granular, crystalline limestone, with thin tortuous black veins of the same material, and if good blocks of this character could be obtained it would make a beautiful marble. Specimens are deposited in the State collection. This stone is said to make a fine lime, and one or two kilns of it have been burnt.

Verd-antique.

This rock occurs in small quantities in various places in Rockland and Orange counties. Those in Orange will be described by Dr. Horton in the appendix to this report. One only of economical importance was observed in Rockland county. It was discovered by Prof. Cassels.

It is on the immediate shore of the Hudson river, about 1 or 1½ miles below Caldwell's Landing, and above Tompkins' quarries. Prof. Cassels describes it as four or five rods wide, measured across the strata, which are rather thick layers and blocks than strata. It is stated that blocks of any reasonable size can be quarried here, free from cracks and flaws. It is of various shades of colour, from a deep spotted green to a beautiful bluish white. It is generally free from pyrites, but some blocks contain crystals of this mineral. The occurrence of this mineral would injure it for sawing and polishing, but Mr. C. reports that most of the quarry is free from this mineral, and that the verd-antique marble from this place takes a high polish. The quarry is on the shore, and vessels can come directly along side. The quarry belongs to Sampson Marks, Esq.

Ores.

Silver ore is said to have been found in several places in Rockland and Orange counties, and many wonderful stories are told about the mines once discovered, and which the discoverers have not been able to find again. I have seen no silver ore or any thing to justify the conclusion that it exists there.

The same remarks may be applied to *lead ores.*

Copper ore is found in several localities in the trap and sandstone region of Rockland county. The strongest indications of copper ore were seen about two miles from Sadenton, by the road side, between that place and Ramapo works. Thin seams and scales of green carbonate and the red oxide, were seen in abundance on and through the trap rock. These minerals were first discovered in the loose masses of the rock, and were traced up to their source in the ledges of trap rock in the hill on the east side of the road. No veins of copper ore were seen, but veins of silicious matter one-fourth of an inch thick traversed the greenstone trap, and the sides of these veins were frequently invested with a thin scale of the ore. It is not improbable that workable veins of this ore may be found in this vicinity. It is well known that copper ore has been found in some quantity associated with sandstone and trap rocks like those in New-Jersey, Pennsylvania, Connecticut, Massachusetts, Nova Scotia, and on the shore of Lake Superior. Many mines have been opened in these various parts of the country, and considerable quantities of copper ore mined and sent to England to be smelted.

The arsenical ores of Orange county are discussed by Dr. Horton in the appendix to this report.

IRON ORE.

Magnetic oxide of iron ore abounds in the mountain region of Rockland and Orange counties. Most of the localities of this ore are on three or four lines which extend across these counties from northeast to southwest. Sometimes the lines are not continuous, but are dislocated by lateral heaves. Their continuity has not been traced throughout, and much time and minute observation would be necessary for a perfect development of these veins.

One of these veins ranges along the northwest faces of the Highlands, and the mines on Butter hill, Deer hill, and probably those of the Clove mine, O'Neil mine, and Forshee mine may be on this vein.

The other ranges from the Forest or Dean mine NNE to Kronkite's mine, Meek's mine, and the ore bed near West-Point. The ore beds on Constitution Island are believed to be a continuation of this vein.

The same vein is supposed to range from the Forest of Dean mine southwestwardly by the Greenwood mine, or else the Hassenclever mine, Patterson mine, Mountain mine, Long mine, Crossway mine, Sterling mine, and mine to the New-Jersey line.

Another range of ore seems to extend from the north side of the Crow's Nest, where a mine has been opened by Round pond and so on towards New-Jersey.

Another still probably ranges from Fort Montgomery by Queensbury mine, and Rich mine, to New-Jersey.

Local Details.

A bed of magnetic oxide of iron occurs about one or two hundred yards east of the reservoir at West-Point. Its quantity is not known, as no explorations have been made. The indications there are as promising as at many productive mines. The ore is associated with hornblende. It has been traced at short intervals for some distance in a southerly direction towards Meek's mine on the west part of Bear hill, southwest of Buttermilk falls.

At *Meek's mine* the ore is titaniferous.

Kronkite's mine on the farm of Richard Kronkite, Esq. is about half or three-fourths of a mile southeast of his house, and four and a half miles SSW of West-Point. There are two veins of ore separated by a sheet of rock. Mr. K. has traced it 50 to 80 rods to the NNE. 800

tons of ore were taken from this mine about thirty-five years ago, and it is said to have made iron of a superior quality. The ore is very rich, and the veins (separated by rock where they have been opened) vary from a few inches to 10 feet thick. They range NNE, and dip about 70° WNW. This place is three miles from Fort Montgomery. The Forest or Dean mine, and others on this vein are described by Dr. Horton in the appendix to this report.

A bed of titaniferous iron ore, much intermixed with a coarse granite or sienite, has been opened on the east side of Bear hill. It was not considered important.

The Round Pond mine was opened many years ago about one-fourth of a mile northwest of Round pond, and a considerable quantity of ore taken out, which appears very pure and a good forge ore.

Another opening was made a few years ago within 100 yards of the northeast part of Round pond, and several tons of ore taken out.

The Smith mine was opened in 1828, about one and a half miles south of Kronkite's landing, between the Crow's Nest and Butter hill. The ore is native magnet. The bed or vein is three or four feet thick and dips with the gneissoid rocks in which it is contained. It was worked by Mr. Smith of Fort Montgomery, who dug some tons of the ore. It has been abandoned for reasons unknown. The statistics of the iron mines of Orange will be found in the appendix where most of the mines are described. The ore is every where associated with gneiss, or granitic gneiss and hornblende.

In bringing this annual report to a close, I may be permitted to express the opinion, that although much has been done to develop valuable resources in the counties under examination, resources that were before unknown or not appreciated, yet, a beginning only has been made; the curiosity and interest of the people are excited; they have received eyes to see that an all-wise Creator has distributed the good things of the earth more equally than has been generally imagined, whether in the mountain or on the plain, amid sterile rocks or the most luxuriant soil, and all for the final benefit of man.

W. W. MATHER.

State Geologist, 1*st District of New-York.*

Jackson C. H., Jackson co. Ohio.
January 22d, 1839.

APPENDIX

TO THE

GEOLOGICAL REPORT OF THE FIRST DISTRICT.

Dr. William Horton, of Craigville, Orange county, New-York, who has for many years been an ardent cultivator of geology and mineralogy, and who has investigated with much care the geology and mineralogy of Orange county, has been engaged during the past season in developing its mineral resources, as one of the Assistant Geologists of the First District. He has collected and arranged in the cases of the State collection in the geological rooms of the First District, 2,888 specimens of minerals and rocks, to illustrate the geology and mineralogy of this county. Subjoined is a copy of his report on the geology of Orange county.

(B.)

REPORT

Of W. Horton, to W. W. Mather, on the Geology of Orange county.

PRIMITIVE ROCKS.

The primitive region of Orange county extends from Butter hill, in the town of Cornwall, along the Hudson river to Fort Montgomery; thence along the line of Rockland county to the State of New-Jersey; thence along the New-Jersey line to the western base of the Pochunck mountain, about one mile southeast of the Walkill.

The northwestern border of the primitive is very irregular, extending obliquely across the county near its middle, in a direction about east and west. It embraces a large portion of the town of Warwick, most of the town of Monroe, the south corner of Goshen, part of Blooming-Grove, nearly all Cornwall, and parts of New-Windsor and Newburgh. By far the greatest part of this primitive region is composed of gneiss. In many places it is regularly stratified, the line of bearing being on an average south 45° to 50° west, and north 45° to 50° east; and the dip to the south and east at an angle varying from 45° to nearly vertical. There are, however, many variations, both in the direction and the dip, but they are local. This rock, in some of its varieties, forms the great mass of the Highlands. For exhibitions of the stratification and dip, many fine examples are seen on the Orange turnpike, and on the turnpike from Canterbury to the New-Jersey line. The local variations may be observed at Sterling mine, and on the road from Canterbury to West-Point, and many other places. It is presumed that the variations in the dip, to be seen on the last mentioned route, induced Prof. Eaton to believe that all the primitive rocks of the Highlands in this county dipped to the northwest.* *In general*, the primitive rocks of the county are less regular in stratification and dip along the banks of the Hudson, and at their western margin, than in their centre. Among the varieties of gneiss in the county, may be mentioned that in which the mica predominates, and that in which the feldspar predominates, as being most abundant; these occur every where. Next in abundance is that which is called hornblendic gneiss and gneissoid hornblende, the hornblende and mica forming the larger proportion of the rock. It is very abundant at Long and Sterling mines, and in all the short ridges and elevations forming the western border of the Highlands. Granite is abundant in the primitive region of the county, constituting beds and veins. It is coarse and crystalline, on the road from Buttermilk falls to Fort Montgomery, and on the turnpike from Monroe works to Haverstraw. It is graphic on Rocky hill in Warwick, and other places. It is sienitic in Mount Eve, at Sterling iron mine, and many other places. It is compact in Butter hill, fine grained and compact in many places on the road from Warwick to the Ramapo river. All the varieties of colour are abundant. The red is particularly so in several of the ridges east of Long pond. While it is not positively asserted that granite, in this county, is a rock regularly stratified like the gneiss, the careful attention of geologists is invited to a locality on the northeast side of the turnpike from Haverstraw to

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* See Journal of Science, vol. , page

Monroe works, about three miles from the latter place; also to many places on the turnpike from the saw works to Bellvale, in Warwick.

Immense quantities of rock are found every where in the Highlands of Orange, which are neither perfect granite or gneiss, but partake of the character of both, or is intermediate between the two; and it is this *granitic* gneiss or *gneissoid* granite, which embraces a large number of the metalliferous deposits found in the county.

HORNBLENDE ROCK.

Extensive strata of this are found in the Highlands, which are well characterized. The most extensive one observed forms the middle of the southeastern face of the mountain first east of the valley of Long pond, in Warwick. This stratum is, perhaps, twenty-five rods wide. An extensive stratum also runs through the Forest of Dean, along the western margin of the white primitive limestone. Magnetic iron ore is associated with this stratum in many places.

In addition to what has already been remarked of the foregoing granitic rocks, it should be further stated that the feldspar is generally in a larger proportion than the quartz. The colour of the quartz is white and bluish, or reddish white. The mica is black, green or intermediate shades of these colours, and the feldspar white, yellow, red and greenish. The hornblende black, gray or greenish.

The minerals embraced in the foregoing rocks are numerous and important.

First are the ores of iron; all the magnetic oxides are found in them. They also contain adularia, fibrolite, kyanite, manganesian, garnet, serpentine, mica, plumbago, sphene, red oxide of titanium, crystallized hornblende, epidote, tremolite, zircon, crystallized augite, tourmaline, coccolite, sahlite.

Beds of other mineral substances are also embraced in the granitic rocks. In the town of Monroe is a bed of quartz. It is two and a half miles southeast of Greenwood furnace. Its northeast end only is visible. At this place it is four rods wide, and rises fifteen feet above the gneiss on each side. It is visible for more than twenty rods, and gradually disappears beneath the surface. The quartz is white and nearly opake, containing in many places pale green coccolite.

Augite rocks exist in many localities; the surfaces are often covered with fine crystals. This may be seen at Greenwood furnace, Monroe, at the mica locality, near the Forshee mines, Monroe, at the Two ponds, Monroe, and numerous other localities. Hornblende in fine crystals at Sterling mines. Serpentine is found in connection with the iron ore at the O'Neil and Forshee mines. A large vein of this substance exists in Warwick, on the east side of Long pond; its breadth is unknown. It is exposed ten feet wide and fifteen feet deep; its colour is dark oil green, approaching black.

The foregoing rocks form the great body of the Highland mountains in the county. They also constitute the rock of many of the short isolated mountains, at a distance from the foot of the Highlands proper, on the northwestern side. Woodcock mountain, in Blooming-Grove, is formed of the granitic rock. It is a mile wide at its northeastern termination, and three miles long.

Round hill, in the same town, is another mountain of the same rock. It resembles very much a half sphere. Pedler hill, in the same town, is still another mountain of granitic rock. Goose pond, Sugar Loaf, Sugar Loaf Mate, Brimstone hill and Snake hill, are all primitive elevations in Goshen and Warwick, separate from the Highlands by intervening mountain ridges of transition and secondary rocks.

Mount Eve and Mount Adam, in the town of Warwick, near the Walkill, are also primitive mountains, formed of sienitic and gneissoid granite. Pochunck mountain, the most westerly primitive rock east of the Delaware river, has its origin on Pochunck neck, in Warwick, and passes into New-Jersey. Snake hill, in New-Windsor and Newburgh, stands like a primitive island, surrounded completely by transition rocks.

Four miles north of Newburgh, is a hill composed partly of the granitic rock. This hill is the farthest north and west of any primitive rock east of Shawangunk mountain.

Half a mile northwest of the village of Washingtonville, in Blooming-Grove, on the farm of Mr. Joseph Moffat, is the last and smallest primitive elevation in the county. It scarcely rises above the surface along the western margin of the limestone, and underlays only a few acres in extent.

All the primitive elevations last mentioned, have a line of bearing similar to the great Highland chain, and their dip is the same, and in the same direction, viz: to the southeast.

The general direction of the Highlands crossing this county, is nearly *east and west*, while the line of bearing of the *individual ridges* composing them, is about *southwest and northeast.* Thus, a ridge forming about the middle of the range on the Rockland line, gradually approaches the western margin of the mountains, until it emerges and forms a part of the northwestern margin of primitive country. Numerous ridges terminate thus in Warwick and Monroe, and do not re-appear north of the great sweep of the Ramapo.

A very striking feature in these Highland mountains, is the absence of long continuous ridges; of these, there are *none.* They are all broken up into short abrupt hills, many of them 1,000 and 1,200 feet high.

Another striking feature is, that the southern terminations of these ridges are very generally abrupt, many of them perpendicular naked cliffs, having the appearance of being broken off, while the northern terminations are gradual, and slope gently to the surface, and disappear.

Butter hill and Woodcock mountains are exceptions to the above appearances: but even Butter hill, steep as it is, has not the ragged broken appearance which many southern terminations exhibit.

WHITE LIMESTONE, PRIMITIVE OR GRANULAR LIME ROCK.

This rock has a distribution of some extent in the county. Beginning on the Hudson river, it is first observed half a mile northwest of Fort Montgomery. It is here several rods in width, and can be traced two miles northeast from the line of Rockland county. It here lies confusedly, the stratification indistinct, rising into short and broken ledges; it is white, and every where full of plumbago, pyrites of iron, boltonite and serpentine, so much so, that it can scarcely be recognized as a white stone. It is, wherever noticed in this vicinity, small, crystalline, and very hard for this rock; this stratum or bed takes the direction of the granitic rocks, in which it is embraced, the line of bearing being northwest and southeast nearly.

Proceeding from this point, directly northwest, six or seven miles along the gorge through which Fort Montgomery creek reaches the Hudson, we reach another BED of this rock. This point is a few rods northwest of the Forest of Dean mine. Here this rock, interstratified with the granitic and hornblende rocks, occupies a breadth of nearly or quite a mile, being wider than where seen at any other place.

From this point, it may be traced northeast by the way of Little Round pond, northeast corner of Bog Meadow pond, southwest by the way of Popelo's pond, and the brook from the Two ponds to Greenwood furnace; thence, with some interruption where it crosses the Ramapo, by the east side of Duck Cedar pond, to the New-Jersey line.

In all this extent, it frequently disappears and again reappears, after having apparently been cut off by the granitic rocks. It is seen in some places only a rod, or even less, in breadth. In many places it is seen in contact with the granite, the gneiss and hornblende rock; sometimes *between* them, sometimes *above* them, and sometimes *beneath* them. It is *not* stratified; in all this extent, which is about twenty miles in a straight line, it is confined between certain limits, and never appearing northwest or southeast of given lines, which may be about a mile distant from each other. It is generally quite narrow, and occasionally it is *cavernous.* Its bearing is southwest and northeast. Its prevailing colours are white and red; much of the red is flesh red, and coarsely crystalline, forming a handsome calcareous spar. It every where contains imbedded minerals; those which particularly distinguish it in almost every locality, are what is believed to be the boltonite of Shepard, and small black spinells. What I suppose to be boltonite, has hitherto been called brucite, which it resembles in some respects. The Mineralogist of the Survey will determine to which species it belongs. This rock also contains beautiful pargasite, sahlite and coccolite; also crystallized augite, scapotite, zircon and sphene; also serpentine and plumbago.

A few trap dykes are seen cutting obliquely across this rock, one of them is partially exposed at the Two ponds in Monroe, and contains imbedded crystals of hornblende.

Three others are visible at the Duck Cedar pond, one of them finely exposed. It is here seen cutting the limestone precipice perpendicularly downwards fifty feet, and running nearly east and west. The trap rock is perfect green stone. A few rods from the southwest end of Popelo's pond where the stream enters it, this rock forms a perfect natural bridge. It is used as such, and one might cross it without being aware, unless the noise of the brook aroused his attention. The breadth of this bridge across the stream is fifty feet, and its length up and down the stream seventy-five or eighty feet. Hornblende rock supports the arch on one side, the other is covered by soil, but it is believed to be granite. This space is spanned by the lime rock. The water, at present, fills the concavity below so that I could not see through; but in times of drought, people pass through it.

This limestone is also met with half a mile southwest of the Queensborough forge, very much resembling that at Fort Montgomery, and containing the same substances imbedded in it. It is here of very limited extent, being confined to a few small elevations of a few rods in extent.

White primitive limestone is also found in the town of Warwick. It exists here on a more extensive scale. Its northern limit is near the line of the town of Goshen. It passes along the east side of Mount Eve. Its southeastern limit is very straight and well defined until it enters New-Jersey. Its western is irregular, passing along the side of Pochunck mountain, thence near the margin of the Drowned lands across the Pochunck creek to Mount Adam. It also passes some distance between Mounts Adam and Eve. At its widest part its extent is more than three miles. It contains every where beds of granite, quartz, hornblende rock and augite rock. It is not stratified, or if so, it is very irregular and confused. True, there are localities where there are appearances of stratification, and a dip to the southeast, but they are very limited in extent.

Its colour is generally white, having the character of calcareous spar. In some localities it is snow white, translucent and compact like Parian marble. Plumbago and mica are very generally disseminated through it. It also contains a great variety of fine minerals imbedded, which will be enumerated in another place. It does not rise into ridges of much elevation.

TRANSITION ARGILLITE.

This rock occupies a large extent of surface in this county. Its general direction is NNE and SSW, varying to northeast and southwest. Some ridges and elevations differ considerably from this course; but these are partial, and extend only short distances. Its colour differs from light ash grey through all shades to black. Its hardness, in some localities, being the softest kind of clay slate; in others, hard and silicious; while others still possess this property in all intermediate degrees. It is every where regularly *stratified*, although the strata, in many places, are singularly bent and contorted.

Its *dip* is uniformly to the southeast, differing considerably in its amount in different places. In some localities its position is nearly vertical, while in others, the angle of its dip will scarcely reach 30°. Perhaps the angle of 50° will be nearest that of its general dip. A little way from the western base of the Highlands, it extends from near the line of New-Jersey in the town of Warwick, uninterruptedly to the Hudson river in Cornwall, New-Windsor, and Newburgh. On the west side of the Walkill river, the same rock comes out of New-Jersey and passes down this stream until it enters Ulster county, and in all this course there is no rock resting upon it.

With the exception of the two ranges mentioned above, it is often overlaid by other rocks; these will be noticed hereafter. It forms the bank of the Hudson, from about three and a half miles above Newburgh, to Cornwall landing, which may be about nine miles. Wherever this rock is seen in this county, it is more or less stratified with graywacke and graywacke slate.

Fine opportunities for observing these alternations, are afforded in the town of Montgomery, at the village of Walden, in the bed and banks of the Walkill, and the banks of the aqueduct which supplies water to the factories; also in the quarries on the west bank of the stream opposite the factories; also in the bed and banks of the Walkill, a little below the village of Montgomery; also in Mount-Hope at and near the village; at Unionville in Minisink, near the New-Jersey line; in the banks of the Hudson at Newburgh, and on the road from Newburgh to Hampton, about a mile from the former place.

On the whole, the alternations of the graywacke are less frequent and less extensive on the east and southeast side of the Walkill, than on the west and southwest. As we approach the foot and ascend the southeastern face of the Shawangunk mountain, the graywacke *covers more surface* than the argillite.

This rock forms a kind of cuneiform termination in Warwick, about half a mile from the New-Jersey line; the limestone meeting round this termination from both sides. From this point, proceeding northeast, the argillite widens into an elevated ridge of rich land, called Long ridge, which extends across this town into Goshen. It forms the surface rock over three-quarters of Goshen; nearly all Blooming-Grove, west of the mountains; parts of Cornwall and New-Windsor; a large part of Newburgh; all Montgomery; all Hamptonburgh, except two or three farms; most of the towns of Crawford and Walkill; part of the town of Mount-Hope, and most of Minisink.

It rises almost to the top of the Shawangunk mountain, the whole breadth of the county at that part.

The stratification of the argillite is finely exposed at the quarries of Mr. Bulmer, half a mile from the village of Sugar Loaf. The bent and contorted appearance is seen to advantage in the bank of the road, two miles north of Goshen. The contents of this extensive rock are not very numerous or interesting. In a few places it embraces *beds* of quartz. Those in the town of Warwick, are the largest I have seen. Some of them may be seen on a cross-road from Bellvale to Thompson's pond. In dip, and direction, they coincide with the argillite, in which they are embraced. Some of them are ten and twenty feet thick. The length could not be ascertained on account of the soil. The quartz of the beds is granular, columnar and crystallized. Crystals are not fine. Seams of argillite and chlorite run through the quartz, and the cavities in the quartz are often lined with a black powdry substance, which is supposed to be manganese in the state of black oxide. Veins of quartz also frequently traverse the argillite. These veins are irregular in their direction, and do not preserve any uniformity in their breadth. The quartz with which they are filled, is precisely similar to that found in the beds just described. Sulphuret of iron, in narrow veins and nests is occasionally seen in this rock. Sulphuret of lead and sulphuret of silver are said to have been found in the argillite of this county; but I have seen none, and presume their supposed discovery has been owing to mistake.

Small veins of fibrous carbonate of lime, having the form and appearance of satin spar, have occasionally been found. Where I have seen them, they are generally in the vicinity of the veins of quartz. A kind of carbonaceous matter coats the seams of the argillite, in a few localities. Tolerable specimens can be obtained at the quarry at the village of Sugar Loaf. In very many places in the county, this rock is loaded with carbon, so much so as to deceive the inexperienced eye into the belief that it is coal; hence the very common belief among us that coal in abundance will yet be found in the county. Mining for coal, in a small way, has been undertaken in several places, and the rock has been penetrated, by boring for this purpose, more than 200 feet. These undertakings have all resulted in loss, and in a few cases, to a ruinous extent. They tend, however, to reveal the true character of the rock, and to show us how small a probability exists of discovering extensive beds of coal in this formation.

True it is, however, that carbon is abundantly diffused through this argillite, and that thin seams of anthracite can be exhibited in many places.

Anthracite is also disseminated in the graywacke in masses from the size of a pin head to that of a pea, so as to give the rock quite a handsome appearance. This is strikingly the case at Walden, on the northwest bank of the Walkill.

The argillite, and its associated graywacke and graywacke slate, no where rise into lofty mountains. When this circumstance is recollected and taken in connection with what has been stated of the extent of this rock forming the great valley of the Walkill, it will be perceived at once how greatly it modifies the surface of the country. There is another remark should be made in this place, in relation to the rock of which we have been speaking. The argillite portion of the county of Orange embraces an unusual *number* and extent of swamps, or as they are called, bog meadows. They are *all* formed by bars of argillite rock across their outlets; this is true from the great drowned lands down to those which cover only an acre or two of surface. *The useful* purposes to which this rock is applied, are not numerous. The most important one at present, is in the construction of fire places and the lining of furnaces. When placed with the edges of the laminæ to the fire, it remains for a long time uninjured. Some varieties in this county, which are not silicious, are excelled by no stone, for this purpose. The quarries of Mr. Bulmer, at Sugar Loaf, furnish excellent stone in abundance; they are sold at from $2 to $5 per load, at the quarry. It is also quarried to some extent on the western shore of Big Long pond, as a fire stone. Roof slate might be obtained abundantly, very similar to the Welch slate, but none is wrought for this purpose.

The argillite is also employed to some extent in the construction and repair of roads; it is, however, but a poor material for this purpose. The surface edges of the rock are generally employed, and these of the variety containing the largest proportion of clay. The wheels soon reduce it to powder so fine that the wind drifts it when dry, and the water washes it away when wet.

Beds of silicious slate and Lydian stone are embraced in this argillite. I have also seen graphic slate, but it is not abundant. In some places, the graywacke associated with the argillite forms a tolerably good building stone. It quarries very well, and works well under the hammer, but it requires great experience in selecting the layers, to avoid those which crack and crumble to pieces when exposed to the weather; this tendency renders it unsafe for masonry of importance. It is employed to great extent in the construction of field walls; a large portion of the county is enclosed by walls of this stone.

GRAYWACKE.

This rock has the widest distribution of any in the county. It occupies all the town of Deerpark, laying northwest of the Basher's kill. In this region, it assumes all the various forms usually called by this name, including the wacke slate. In some of the ridges of mountains, it is in thick massive layers, dark coloured and compact. In others, it is in layers of but a few inches in thickness, light gray colour, very hard and sonorous, when a blow of the hammer is applied. In others, still, it is soft; colour, dark and dull, with a strong tendency to decomposition; and finally it passes into wacke slate, which is sometimes the colour of the rock, and at others nearly brick red. Between the Neversink and Mongaup rivers, the redwacke runs nearly across the town. The direction of the mountain ridges in this section of the county, coincide very nearly with most others to the east, that is, northeast and southwest nearly. There are, however, some variations. Some of the strata lay quite flat, approaching a horizontal position; others are much more inclined. The general angle of dip may be included between 15° and 25° to the northwest and north. The Delaware river occasionally runs a short distance between these ridges, but generally crosses them obliquely. At low water, the hardest layers of the rock may be seen in many places forming a reef across the stream. From a little below the mouth of the Mongaup, the Delaware takes the direction of the strata for near three miles before it finds an exit to the south and east. In this distance, the mountain attains an elevation of 800 or 1,000 feet; in some places, it is almost perpendicular. Here nearly all varieties of this rock may be seen, except the red. Most of these three miles, the Delaware and Hudson canal is built in the river, the mountain forming one bank, and a wall of stone from fifteen to twenty-five feet high, on which is the tow-path, forming the other bank. The strata of graywacke extend from the Delaware river into Sullivan county. In this stratum, west of the Shawangunk mountain, I have not been able to detect a single fossil in place, although faint arborescent appearances are discoverable on the surfaces of some layers. The Shawangunk mountain extends in a single unbroken ridge from the New-Jersey line to Sullivan county. Near or at the summit of this ridge, the graywacke appears again, but here its position, at first nearly vertical, as we descend to the southeast, soon becomes reversed, that is, while its direction continues the same, its dip is to the southeast, at an angle varying from 45° to 90°. Here it is occasionally interstratified with the argillite. As we proceed southeasterly, before we reach the Walkill, the argillite becomes the predominating rock. Over this space, viz: from Shawangunk mountain to the Walkill river, this rock, with the alternating argillite, extends unbroken from New-Jersey to Ulster county. Over the remainder of the county, until we reach the primitive region of the Highlands, it every where accompanies the argillite, and is interstratified with it. It is the first rock next the primitive. It is found in several valleys between the western ranges of the primitive, and even mounts some distance up their sides, particularly the western.

Bellvale mountain extends quite across the town of Warwick. The southeast side, the top, and about one-third of the descent on the northwest side, are composed of graywacke and graywacke slate, standing nearly vertical. Its colours are gray, greenish and bluish gray, and brick red. Many of the layers are completely chequered by veins of milky quartz traversing them in all directions. While it passes on one hand into graywacke slate, or graywacke shale, on the other it becomes a perfect conglomerate.

Skunemunk is similar to Bellvale mountain, passing unbroken nearly across Monroe. Its southeast side, top, and part of northwest side are graywacke in all the same varieties. It is not in a line with Bellvale mountain, neither do their lines of bearing quite coincide. Most of this mountain has the dip, &c. of Bellvale mountain; but *High point* has the rock dipping to the *east*, and some part of it even to the *northeast.*

On some of the small ridges northeast of Bellvale mountain, the graywacke is seen forming their northwestern sides, while the opposite or southeast side is primitive rock. One of these may be seen a mile west of the Friends' meeting-house, in Monroe. In these cases the line of bearing and dip of the graywacke coincide with those of the primitive, and the graywacke has the appearance of passing beneath the primitive rock. At the western base of Goosepond mountain and of Sugar Loaf Mate, the slate has the same position in reference to the primitive, and exhibits precisely the same appearances. These circumstances being precisely similar are mentioned together, so that future visiters to the neighborhood may notice both. In many places both rocks are visible but a few feet apart, but I have not seen them in actual contact. This position of the two rocks so different in age, is singular and interesting. In the banks of the stream from the village of Canterbury to the Hudson, nearly all colours and forms of graywacke may be seen. Also in the banks of the Hudson, from Cornwall landing a mile up the river to the mouth of the creek. *Pine hill* east of Skunemunk is a graywacke ridge, composed almost entirely of the red, slaty, compact and conglomerate forms. Woodbury furnace is built from the red stone of this hill. It makes an excellent building material, and resembles in all respects sandstone.

Fine quarries of the blue flagging stone might be opened in Skunemunk mountain, and of the red, resembling the sandstone, in Pine hill.

LIMESTONES.

Limestones, or as they are called in many parts of the county, blue limestones, of these there are several. The oldest, and that which occupies the lowest position geologically, is the sparry lime rock, or chequered rock.

A stratum of this rock commences on the bank of the Hudson at Hampton, where Orange is bounded by Ulster county. It is about one mile in width from northwest to southeast. Its direction is very nearly SSW, passing about a mile northwest of the village of Newburgh, into the town of New-Windsor, and disappears beneath the surface finally, in the vicinity of a small body of water called Little pond, in the latter town. With the exception of one locality, its dip is to the southeast at an angle of 30° to 60°. The exception referred to is at Hampton, on the bank of the river; here this rock attains an elevation greater than at any other point in this stratum, and the oblique ends of the layers as they come out to the river bank, appear as if they had been elevated into a position which gives them a dip of 30° to 40° to the west and northwest. The elevated point of this rock at Hampton, and a similar but less elevated one a little below, called the
form the northern termination of the long bay of Newburgh.

Many of the layers of which this stratum is composed are from two to four feet thick; they are solid, compact, and some of them breaking with a perfect conchoidal fracture. The layers differ considerably in colour, part being a very light and part a very dark gray, and both traversed in all directions by narrow seams and veins of white calcareous spar. Occasionally nests of quartz crystals and brown spar are noticed. I have not discovered a fossil in this rock, nor could I learn that any have been seen by others. In a quarry of this rock belonging to Mr. Charles Collier, the surfaces of the layers are covered with a very white incrustation, which forms handsome specimens. It has the appearance and hardness of arragonite. Veins of white quartz and nodules of black hornstone are common in some of the layers. This stratum is employed extensively for burning into lime.

Another stratum of sparry lime rock, farther to the south and east makes its appearance about a mile east of Salisbury mills, in Cornwall.

It is here but a few rods in width, and not far distant from Skunemunk mountain. It is visible, with a few interruptions, across Blooming-Grove and Warwick, to the State of New-Jersey. It is seldom more than a mile in width. It resembles closely the stratum near Newburgh, but at no point rises so high above the surface. In the village of Warwick, it affords good specimens of crystallized quartz, and crystallized brown spar. Fifty or sixty rods west of the Presbyterian church, in the same village, some of the layers are a light red colour, very close and compact in structure, and gives the argillaceous odour when moistened. The lustre is quite dull, and it breaks with a flat conchoidal fracture. There is evidently much clay in the composition. It has been supposed to be the water lime, but there are more glimmering particles in it than in the hydraulic lime of standard localities. It has also been examined in reference to its fitness for a lithographic stone, but does not prove good. It is called red marl in that vicinity.

The minerals noticed in this rock, are quartz crystals, crystals of brown spar, crystals of oxide of titanium, and magnetic iron ore, so strong as to have given it the name of native magnet.

In Hamptonburgh, limstone exists as a bed in the argillite. This bed is about two and a half miles long, and fifty or sixty rods in breadth. The contact of the two rocks is no where visible, although they are within a few rods, and in some places but a few feet distant. This bed has the same direction and inclination as the argillite. It is all fetid, and contains cubic crystals of sulphuret of iron, which are of a bright yellow colour. Most of the layers are the usual colour of sparry lime rock; some however are very dark coloured, so much so that it was supposed to contain coal; an excavation was accordingly made for this mineral; it need scarcely be observed that no coal was found. The surfaces of some layers are full of the fossil shells of the very early periods of animal life. The stone of this bed has been long used for lime, but the quality is not very good. The argillite closes round both ends of this bed. It is called the Neelytown limestone in the neighborhood where it lies. Limestone exists abundantly in the town of Monroe, particularly in the north and northwest part of it. It is abundant about two miles north of Greenwood furnace, near the point where the Ramapo river enters the Highlands. It is here spread out to a breadth of near two miles, and a part of it extends southwesterly to the neighborhood of Long pond.

It is much used as a flux in the iron furnaces, and but very little for lime.

A small bed of similar limestone is found in the town of Cornwall, half a mile southwest of Ketcham's mill. It is stratified and dips to the southeast. Limestone is also found in great abundance in Goshen. It begins two and a half miles southwest of the village, and extends from the Walkill southeast to Thompson's pond, a breadth of six or seven miles, and in length to the south and west, it extends into New-Jersey, across the town of Warwick, west of the stratum already mentioned. The western edge of this limestone underlays the drowned lands and most of the islands in them, and passes along the northwestern margin of the white primitive limestone of Warwick. Another part of the same rock passes along the whole southeastern margin of the same primitive limestone, and crosses the line of New-Jersey with it; in other words, when this limestone meets the primitive rock, it divides into two branches; one proceeding along the northwestern, and the other along the southeastern margin of the primitive until they all enter New-Jersey. I have not seen them in contact, but they are every where in close proximity; no other rock intervening. At the line of New-Jersey, this rock, with the included primitive, occupies a breadth of nearly eight miles. The northern terminations of the ridges of this limestone interlock with the southern terminations of the argillite ridges. This singular interlocking of the two rocks can be finely seen three and a half miles from Goshen, and a half a mile southeast from Mapes' tavern; also, a little farther southeast, at the limekiln of Mr. H. W. Thompson. I have been able to detect no fossils in this limestone, except near the limekiln first mentioned, and these are in the upper layers, associated with the conglomerate limestone on the land of Mr. Thompson. The pebbles, of which the conglomerate is composed, are all smooth and apparently water-worn; all sizes, from that of a pea to several pounds weight; all shades; of light-gray to dark-brown, and nearly black, firmly cemented, and all burn into excellent lime. The dip is here to the southeast from 3° to 10°.

A mile west of this is a lofty hill called Mount Lookout. It is composed entirely of limestone; its southern, western and northwestern boundary is a circular wall of limestone, about perpendicular, and at a distance having quite the appearance of trap-rock. It lies in a position nearly horizontal, having but a very slight inclination to the west. In this neighborhood the limerock abounds in hornstone, generally black. When the western branch of this limestone reaches Great island in the drowned lands, its dip is to the northwest, and so continues to New-Jersey. The eastern preserves throughout, its usual positions. A small portion of this limestone is found in Minisink, on the west side of the drowned lands. This occurs at a point where the Walkill makes a considerable curve to the east.

On Big island, in the drowned lands, some of the layers of this rock are oolitic, in several places near the village of Warwick; also half a mile north of New-Milford.

On Pochunck neck, about three miles from the New-Jersey line, some of the layers differ from any seen in the county. In some of the perpendicular cliffs, the edges of many layers are exposed, naked, one above another; some of these are of the usual character, others are oolitic; but the round granules are bluish white quartz; other layers still are slaty, approaching the calciferous slate; some of it has a ribbonlike appearance; the laminæ of light and dark-gray alternating in the layer. A locality, nearly similar, may be seen at Bellvale, on the land of Mr. Wilson. At this place some of the layers contain but little lime, and approximate closely in appearance the calciferous sand-rock of Prof. Eaton.

The lime rocks of a later formation, which are found in the county of Orange, remain to be noticed. In the town of Deerpark a stratum exists, which extends from the New-Jersey line to the county of Sullivan. It reposes unconformably upon the mill-stone grit at the western base of the Shawangunk mountain; its position is almost vertical, the dip to the southeast; some layers of this stratum appear to be almost composed of shells, in others they are less numerous. Among the contents are two species of trilobite, the orthoceratite, terebratula, &c. Some layers of this rock appear to be a slaty calciferous graywacke, and some are impure limestone, hard and compact, as well as slaty.

These rocks, as a whole, form a narrow range of hills, or low mountains, sometimes sinking almost to the level of the Neversink valley, and at others rising to one-third or half the elevation of the Shawangunk. They are always narrow, and generally close to the base of the last named mountain. The rising and subsiding of the tops of this ridge affords one of the most prominent features of this valley, and adds greatly to its picturesque beauty.

I have said that these lime rocks repose unconformably on the grit-rock composing the Shawangunk mountain, that is, dipping southeast, while the grit dips northwest; this, however, is far from certain. The stratification is to me still uncertain; this much may now be stated as fact in this county. If the rock dips north and west, the slaty laminæ cleave at about right angles to the dip. These rocks require further observation up and down the valley, to settle their position.

Carpenter's point, between the Delaware and Neversink rivers, is composed of a dark coloured, impure limestone, apparently dipping to the north and west, running a little southeast of Port Jervis; it composes a part of the ridge last described. There are none of the limestones in this valley which burn into good lime.

A limestone, containing abundance of fossils, is found in the town of Cornwall, two and a half miles west of the village of Canterbury, on the road to Salisbury mills. Its apparent position is between the slate and grit-rock, or millstone-grit of Prof. Eaton. Its dip is to the southeast, at a high inclination. Mixed in between the layers of this rock is the hematite, or limonite ore, on the land of Mr. Thomas Townsend. Where the ore exists, the limestone is all more or less decomposed, some parts of the rock and its fossils retaining their form, but have become white or yellow, and soft, other parts, even the nodules of hornstone, are so far changed that they have fallen to fine powder, mixed up with the ore in the same condition. This limestone makes but indifferent lime. The distinctive fossil of this rock is the encrinite, although it contains many others. Limestone also is seen connected with limonite, a quarter of a mile north of the Clove mine, in Monroe. But little of the limestone, or ore, is exposed; not sufficient to reveal their position or relations.

On the whole, our blue limestone formation is abundant for useful purposes, and conveniently distributed. It is found in Newburgh, New-Windsor, Cornwall, Monroe, Blooming-Grove, Hamptonburgh, Goshen, Warwick, Minisink and Deerpark. That of Cornwall* and Deerpark, where observed, does not burn, and perhaps cannot be burnt into very good quick lime, but in all the other towns mentioned, the stone is precisely similar to that from which so much and such superior lime is burned in Newburgh. All that is required are care and experience in selecting and burning. This statement is necessary since the belief has become common, that there is little if any good limestone in the county, except at Newburgh, and as a consequence, the Newburgh lime has comparatively excluded all other from use.

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* This remark is not intended to include the bed near Ketcham's mill or the white primitive limestone.

It is a common belief in the county, that the limestone from beneath the surface requires less fuel to reduce it to lime than that taken from the surface.

As a building material, some of our limestones are not surpassed by any found in the State. Those of Neelytown in Hamptonburgh, and Mount Lookout in Goshen, are peculiarly fine. That of Mount Lookout is a handsome dove colour, and perfectly durable. It can readily be obtained of any length and thickness required.

MILLSTONE GRIT, (*of Eaton.*)

All the northwestern side of the Shawangunk mountain is composed of this rock. It is regularly stratified. The line of bearing being about north 50° east, or south 50° west. The dip to the northwest, at an angle of 30°. This rock extends, without interruption, from the New-Jersey line to Sullivan county, and from the base of the Shawangunk* mountain to the top; in some places it caps the top of the mountain, and in others the slate of the eastern side is the highest. I have not seen the two rocks in actual contact, although they are close to each other the whole length of the county.

The structure and composition of this rock varies in different layers from fine grained, nearly compact, to that which is composed of pebbles the size of filberts. Most of the layers are very hard, some are sandy, and others even slaty. Its colours are white, gray, grayish and reddish white, and brick red.

About one-third of the distance from the bottom of the mountain is a belt of the red coloured rock; it is about two rods wide, the layers corresponding with the layers of the other colours, and it extends quite across the country. In many places hard specimens could not be distinguished from the New-Jersey sandstone.

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* Shawangunk, pronounced by the Indians Shong-gum, meaning white stone, is very appropriate. People now living, have had this explanation from the lips of the Indians.

The same rock is found in the town of Blooming-Grove, but in a different situation and position. It is first found in this town on the southeast side of the Round hill.

Round hill, like the Highland ranges, is primitive, and here the grit rock inclines against and rests upon it. The grit rock is regularly stratified, line of bearing same as in Shawangunk mountain, but it dips to southeast. It passes through all kinds of composition, from compact to soft and slaty on one hand to a coarse conglomerate on the other; and all shades of colour, from milk white to brick red. From the point mentioned, it extends northeast nearly four miles, until intercepted in its line of bearing by a part of Woodcock mountain, which is primitive.

A similar rock is again found in the southeastern face of Skunemunk mountain, and at its base. But here it is interstratified with the graywacke and graywacke slate, and while all the colours already mentioned exist here also, there are some layers which are different. The pebbles of which these layers are composed are much larger, and about half of them are very white, and the remainder very red. All the pebbles are smooth, as if water worn.

These layers extend as far south as Skunemunk mountain, and about two miles farther north than the mountain itself does. The Hematite mine of Mr. Thomas Townsend, is connected with this rock, two and a half miles west of Canterbury.

Pine hill, a ridge next southeast of Skunemunk, is composed of this rock; it is near three miles long, narrow, and somewhat elevated. In this hill the rock is almost entirely red, and can be quarried in handsome blocks for building. Woodbury furnace is built of stone from Pine hill; it has all the appearance of freestone, except that it is rather more variegated than most American sandstones. It bears a high temperature very well. No fossils have been seen in this rock any where.

CLAYS.

Kaolin is found in a few places in the Highlands. One locality, a mile north of Southfield furnace, on the Orange turnpike, affords indications of its existence in some quantity. It has not been tested as to its value in the manufacture of Porcelain.

The blue and gray clays form an extensive stratum, underlaying the soil over a large portion of the county, particularly all that portion underlaid by the graywacke and slate rocks. These clays are all more or less marly, that is, contain lime in their composition. Some of the blue clays contain so much lime as to injure them for the purposes of making brick; clays of this description are manures of great value for sandy soils, by supplying directly the two substances most valuable on such soils, viz: clay and lime. There is no reason to doubt that these beds of marly clay will at a future day be extensively employed as manure. Their extensive distribution, and nearness to the surface, renders their use peculiarly convenient and cheap.

These clays also furnish an inexhaustible supply of material for the manufacture of brick. Some of our clays have thin layers of fine sand between the layers of clay, thus affording the materials for brick without mixture.

From these clays there have been made the present season, bricks to the following amount:

In Cornwall,	F. Clark,	1,260,000
do	W. Stringham,	1,000,000
do	N. Audams,	3,000,000
Walkill,	M. L. Sproat,	300,000
Goshen,	S. C. Wood,	300,000
Newburgh,	Norris,	2,100,000
do	Anderson,	300,000
		8,260,000

These, at the average price of $5.50 per thousand, give $45,440, as the income of the county for one year, from our clays.

This sum, however, is not a fair average product. There are some places not included in the above estimate, where bricks are burned occasionally, but not as a steady business; and at the places above enumerated, less than usual have been made on account of the stagnation of business, the last two summers.

IMPROVEMENT OF THE SOIL—MANURES.

From the peculiar situation of this county, bordering on New-Jersey and Pennsylvania, and from its water transport being by the Hudson river and by the Delaware and Hudson canal, it is impossible to ascertain, with any thing like accuracy, the amount of plaster of Paris consumed annually in the county; enough, however, is ascertained to acquaint our agriculturists with the amount of its cost, and to admonish them to look among their own resources for mineral manures. During the present season, exclusive of that sent up the Delaware and Hudson canal, there have been sold in the county 5,200 tons of plaster in the stone, at the average price of $5.50 per ton; to this must be added $2.50 per ton for grinding and transport, and we have the sum of $41,600 as the annual amount paid by the farmers of the county for mineral manure.

A great part of this sum might be retained in the county, if farmers would turn their attention to their own mineral resources. Their limestones, marls and bog earth, or vegetable matter of our bogs and swamps, and marly clay, furnish inexhaustible supplies of the best manure, adapted to all kinds of soil and culture.

Marl exists in almost and perhaps every town in the county, and every land-holder can soon ascertain whether he has it upon his land, without the cost of a dollar; for in this county it lies *naked*, or covered by water, or bog earth and peat. He has only to open a space a foot or two square with a spade, through the black earth, and if it exist, it will be found at the bottom. It has not been much used as a manure up to this period. The few trials made have generally been unfavorable, and from the very circumstance of all others which should have recommended its continuance. Marl, where the trials have been made, was so cheap, and so easily got and put on the land, that too great a quantity was used, and all vegetation thereby destroyed, as effectually as if too much quick lime had been used. A field was pointed out to me by an intelligent farmer, where marl had been applied twenty-nine years ago. The field is now in grass, and the boundaries over which marl was spread are still as visible as if a plough had been drawn around it; too much was used, and nothing would grow on it for many years, but within the last few years, corn and wheat have grown and yielded bountifully; but there is yet too much lime for grass, which is thin and sickly: nevertheless, this trial, although a failure, speaks volumes to the farmer; it proves how small a quantity answers without renewing.

Some of our marls are very strong, and it is believed would burn into good quick lime; some are full of shells, and some are nearly destitute of them.

Another of our mineral manures is lime; it is only beginning to attract notice for this purpose. When the cost of wood for burning lime is lessened by the use of coal and peat, there can be no doubt it will be extensively used as a manure.

The amount of lime burned in the county this season is as follows:

Goshen,	10,650 bushels
Hamptonburgh,	1,400
Minisink,	1,400
Warwick,	4,200
Newburgh,	165,000
Total,	182,650

This at an average price of 25 cents per bushel, yields the sum of $45,662.50, as the product of this branch of our industry, per annum.

WATER.

Orange is abundantly supplied with springs and streams; on one side is the Hudson, on the other, the Delaware. The Neversink river and Basher's kill enter this county from Sullivan, and empty into the Delaware. On these there is considerable fall. Part of the summit level of the Delaware and Hudson canal is in the county; the last mentioned streams are used as feeders.

Three or four miles from the New-Jersey line, at the eastern base of the Shawangunk mountain, rises the Shawangunk kill. It pursues a northeasterly course at the foot of this mountain, to near Bloomingburgh; thence it separates Sullivan and Ulster counties from Orange, and finally falls into the Walkill, in Ulster.

The Walkill enters the county from New-Jersey, and pursues a very serpentine course without any fall, through the drowned lands, to the outlet. From this point to Ulster county, northeast of Walden, there are occasional falls and sites for water power.

The great marsh, or as it is called, the drowned land, covers an extent of 17,000 acres in this county, and 3,500 in New-Jersey. At high water, this surface is covered, and again laid bare by drainage and evaporation. Many parts of the shore have been annually visited by fevers; since the partial draining has been effected, these have measurably disappeared. This tract appears once to have been a lake, and has been gradually filled to its present level by vegetable matter. It is now a vast body of peat of different qualities. Much of it is very good, covered only with undecomposed vegetable matter. In some places, the peat is underlaid by shell marl. Several islands are scattered within this tract; they are all limestone land of the best quality, and afford many facilities for burning lime, particularly on account of the abundance of wood in the marshes which surround them. The drainage of this marsh has long been an object of great interest, not only to the proprietors, but to others in the vicinity. Many years since, a large sum was expended for this purpose, in cutting down the bed of the river at the outlet, four miles west of Goshen. This trial partially reclaimed many acres at the shores. The proprietors are now employed in making a new channel for the stream, or at least for the surplus water, near two miles in length; the water now flows in this new channel, and is gradually wearing it broader and deeper. By this channel, it is proposed and expected to render available nearly 30 feet fall. This amount is deemed sufficient to lay the whole tract dry.

If this effort to drain succeeds, and there appears no good reason to doubt it, 20,000 acres of the richest land will be reclaimed, and the surrounding country made healthy.

The Otter kill rises near Thompson's pond; runs through Goshen and Hamptonburgh northeasterly, and falls into Murderer's creek, near Washingtonville. Graycourt creek rises from Little Long pond in Monroe, runs through Blooming-Grove, receives the Otter kill, takes the name of Murderer's creek, and falls into the Hudson, near Cornwall landing.

The Ramapo river has its origin from the Two ponds in Monroe. The Long pond gives rise to part of this river. Its waters run easterly until they enter the Highlands, near Greenwood furnace. The other branch of the Ramapo issues from Mount Basha's pond, winds around and between the mountains, passing Southfield furnace, unites with the other branch at Monroe works; the stream thence pursues a southerly course into Rockland county.

Numerous small streams intersect the county in all directions. A stream called Fallbrook discharges its waters into the Neversink in the town of Deerpark. About a quarter of a mile before it meets the Neversink, it falls over the face of the mountain, forming a beautiful cascade; the whole fall, within the first mile, is said to have been ascertained by Col. Clinton, and found to be 600 feet. About 200 feet of this fall is almost perpendicular.

Our natural ponds or lakes are numerous, and some of them of considerable dimensions. Thompson's pond, in Warwick, covers nearly

100 acres. It gives rise to Quaker creek, a branch of the Walkill. Wickham's pond, lies in Sugar Loaf valley, and discharges its water into Warwick creek. It is surrounded by marsh which is filled with peat, and in some places underlaid with shell marl.

Long pond, or Big Long pond is partly in Orange, and partly in New-Jersey. It is ten miles long and from one to two broad. It is used as a reservoir for the Morris canal.

Round pond and Long pond in Monroe have been mentioned already. Mount Basha's, or as it is called Mombasha, is in Monroe, a mile southeast of the two last mentioned. It is two and a half miles long, and a half to one broad. Sterling pond or lake is a beautiful sheet of water in the corner of Monroe and Warwick, about two miles in circumference, and entirely surrounded by mountains. Its water is finely transparent, and said to be the deepest of any in the Highland mountains. It is the last to freeze in winter. Its waters pass into New-Jersey by way of Ringwood.

Duck Cedar pond in Monroe is narrow, but about two miles long, discharging its waters into the Ramapo, at the saw works. The waters of this pond are so near the level of Ringwood and Sterling valleys, that during the war of the revolution, when operations on the Ramapo were too near the British lines, a dam was erected across the north end and its waters thrown to the southwest to supply the furnace and forges at Ringwood.

In the southeast part of Monroe, are the Cedar pond, Long pond, Green pond, Carr pond, Island pond, Slaughter pond and Two ponds.

In Cornwall, are Round pond, Long pond, Reservoir or Bog Meadow pond, Cranberry pond, Bull's pond, Popelo's pond, and others; these however, are the largest; all are used more or less as reservoirs to supply deficiencies of water in seasons of drought. In Newburgh, about six miles north of the village, is Big pond; a mile wide and nearly three long.

In New-Windsor, a mile west of Snake hill, is Little pond. The water from this pond sinks into a cavern in the limestone and disappears; three quarters of a mile distant, a stream, believed to be the same, emerges from the ground. At times the stream can be heard beneath the ground, 30 or 40 rods, before it bursts out at the surface.

Several of these lakes, in the purity of their waters, and in the beauty and magnificence of their mountain scenery, vie with the celebrated waters of the north of England.

Our springs are numerous; a few are believed to be medicinal waters; some of them will be presented to the analyst of the survey.

The spring and well waters of the county are considered good; but in all parts underlaid by graywacke and slate rocks; much of the water is *hard* from containing a salt of lime in solution. This is probably derived from the rocks, or the stratum of blue marly clay so extensively spread on them.

PEAT.

In the drowned lands, several thousand acres are covered with this substance; it is from three feet to several yards in depth, and on trial proves a good fuel.

The Greycourt meadows, lying in Goshen and Blooming-Grove, contain 500 acres of peat, several feet in depth. It exists in great abundance in Warwick, Minisink, Goshen, Monroe, Cornwall, Blooming-Grove, New-Windsor, Newburgh, Montgomery, Hamptonburgh, Crawford, Walkill and Mount Hope; all the towns in the county except Deerpark. In this latter town the quantity is small. The quantity in the county is unusually large in proportion to its extent, perhaps as much or more so than any other county in the State. It would require a great amount of time to ascertain the number of acres. It is perfectly inexhaustible. If its consumption for fuel ever becomes as general as it is in some parts of Europe, the Greycourt meadows and drowned lands would prove a source of immediate revenue to their proprietors.

ERRATIC BLOCKS—BOULDERS.

These are found in the county in the greatest profusion. Most of the surface is thickly dotted by them, and in many places they are so numerous as to prevent cultivation. Under this term, however, it is not intended to comprehend any rocks or stones, except such as have been removed to considerable distances from the place of their formation. Over the whole surface, from the Highlands on the southeast, to the Shawangunk mountain on the northwest, perhaps nine-tenths of the loose stones are graywacke. Many of them are unlike any rock of this description in the county, while others resemble and no doubt were broken up from the layers upon and near which they now lie. The parenrock of the former is to be sought for beyond the bounds of the county, but where, has not fallen under my observation.

The next most common and widely spread boulder, is what is called Esopus millstone, and white flint rock, or the millstone grit of Prof. Eaton. These are found abundantly over all that part of the county between the mountains. They are, almost without exception, completely rounded—none are flat or angular. They are evidently more numerous, and much larger in the northern than in the southern towns. In Montgomery and Crawford, they are often too large to be removed by the efforts and industry of man, even when aided by gunpowder; some may there be seen of five hundred tons weight, and probably much more. As we proceed south, they gradually diminish in size and frequency. How far they extend, I am unable to say, but I have seen them near the New-Jersey line. These boulders are pretty uniform in appearance; their colour is white, bluish, or reddish-white. It is seldom compact, but generally composed of grains and pebbles from the size of small peas to that of white walnuts, and sometimes much larger; some of the pebbles are smooth and rounded, others are angular—nearly all are united by a silicious cement. In a few, iron pyrites exist as the cementing substance, or disseminated through the mass; this decomposes when exposed by a fresh fracture, and gives the rock a greenish appearance.

From what has been stated, I think these masses have been brought into the county from the north by the agency of water. A rock stratum is seen in Blooming-Grove, precisely similar to the boulders just described, but this is shut in by two elevated primitive ridges, and its fragments have had a limited distribution, and can be readily traced to its limit within the county. Boulders of the same millstone grit, and of the same appearance and character, are also found in the valleys of the Neversink and Delaware, but these can also be traced to a stratum in that vicinity, whose fragments have taken a direction not to be mistaken. Another stone which has attracted some attention in the county, is the *labradorite.* Its existence was first noticed by Dr. Heron, of Warwick, several years since. In addition to Warwick, I have seen it the present season in Goshen, Minisink, Walkill, Hamptonburgh and Blooming-Grove. No doubt if sought for, it might be found in many other places; it is found in pieces weighing from a few pounds up to three or four tons. They are all rounded, and very much worn, having the appearance of travellers from afar. No rock formation of this kind is now known to exist nearer than Essex county. Some pieces of these boulders have been polished, and prove very fine. They usually reflect only the green and blue colours. The best I have seen is in Warwick; also in Walkill, upon the farm of Dr. Shaw; and in Blooming-Grove, upon the farm of Joseph Moffat.

Many other erratic stones are found, not deserving particular notice, but it should be remarked, that wherever transported fragments of a rock are seen in the county, they are always to the southward of the parent rock. Thus, from the south end of Mount Eve, a chain of blocks can be traced for miles, even into New-Jersey, of a character so peculiar as to render mistake impossible. Another stone found in rolled masses, in the county, is jasper. They are yellow, striped, red and black. Many of them contain cavities, lined with small but beautiful quartz crystals, and coatings of white, blue and yellow chalcedony. Some of the jasper boulders are coarse, some fine and compact, some slaty, and some ferruginous. They have but a limited distribution, being found only at the foot and on the northwestern declivity of Bellevale mountain, in Warwick.

IRON ORE.

This valuable mineral substance is found in Orange in great abundance. With a few exceptions to be noticed hereafter, it is associated with our primitive rocks. The most abundant as well as most valuable ore, is the magnetic oxide. It is generally found in that species of primitive rock so common in the highlands of the county, and often called granitic gneiss or gneissoid granite It lies in beds and layers in this rock, having its line of bearing and its dip. Where it exists in layers, they are from one inch to twenty feet in thickness, in some places alternating several times with the layers of rock. Where it is found in beds, the magnitude of the largest has never been ascertained. In the line of bearing, the extent of our deposits of this ore is not yet well ascertained.

On the southeast side of Butter hill it is traced from the river, and from nearly opposite the village of Canterbury, by way of Monroe, quite into New-Jersey, a distance of about twenty-five miles.

The most westerly of the great ore deposits now wrought, is called the *Clove mine.* It is the property of George Wilks, Esq. situated about a mile south of the village of Monroe. It has been open many years, and much ore has been used. The ore is the magnetic oxide. It is compact and granular. The latter is called shot ore. The pyrites is more or less disseminated through it. It makes *red* or *hot* short iron.

It requires roasting before it can be used. At the south end of the mine exists what is here called soft ore; this is the ore in a black powder. It is taken up with the shovel, ready for use, requiring no roasting process. It would seem to have resulted from the decomposition of the pyrites, and is abundant. The solid ores of this mine are in layers, having the direction and dip, and alternating with the rock. The layers are from a few inches to a yard and more in thickness. Several successive layers, and the intervening ones of rock, have been penetrated in three places; a few rods distant from each other. A large quantity of the soft ore has been used. Altogether, the mine has been opened about 500 feet in length, and evidently extends over a much larger surface, in all directions.

The immediate associates of this ore are mica, hornblende, quartz, feldspar, asbestos, occasionally carbonate of lime, serpentine, chrome crystallized in octohedrons; the latter however, is rare. A kind of soapstone is also connected with this ore.

About one mile southeast of the Clove mine, in a straight line, is the *O'Neil mine*, or as it is commonly called in the vicinity, the Nail mine. This is a vast bed of magnetic oxide of iron. It is often in the seams, beautifully crystallized in octohedrons and cubes; the latter are rare; it also contains pyrites, and requires the roasting process. Magnetic pyrites are also occasionally found in this mine; the ore is very hard and compact; the most so of any of our standard ores. This ore is very much esteemed. It makes a good iron, which is of the *red short* description. This mine is the property of Gouverneur Kemble, Esq. Large quantities of this ore are used. The bed is now open 150 by 500 feet. A wall is partially exposed on the southeast side, but no appearance of limit is any where else visible. One dyke has been crossed, which is several feet thick, cutting the bed perpendicularly, and nearly east and west. The immediate associates of the ore in this mine, are calcareous spar white and abundant, rose coloured garnet, green coccolite, dark coloured sahlite and hornblende massive; arragonite, the flosferri variety, amianthus, and serpentine.

Forshee Mines. These are a quarter of a mile southwest of the O'Neil mine. It is composed of a great number of layers of ore, alternating with the layers of rock. The whole hill, which is more than one-fourth of a mile long, and nearly as wide, appears to consist of rock and ore, the ore forming a large proportion of the whole. Some layers are granular, forming handsome shot ore; some are compact, and rather more free from pyrites than usual. In these mines are large bodies of the ore in black powder, which is entirely destitute of pyrites. Umber also is connected with the Forshee mines, and appears to be abundant and of fair quality.

The minerals, associated with the ore of the Forshee mines are red garnet, brown tremolite, green coccolite, serpentine yellow and black, calcareous spar, asbestos and mica.

Five miles southeast of Monroe works is the *rich iron mine*, the property of Hudson McFarlan, Esq. It is a fine rich ore, strongly magnetic. It has not been extensively wrought, although there are evidences of an abundant deposit. Connected with this mine, are mica, hornblende, or as this mineral is generally called in Cornwall and Monroe, black-jack-sahlite, magnetic pyrites.

The *Greenwood mine* is two miles southeast of the Greenwood furnace in Monroe. It is in the granitic gneiss. Three layers of ore, separated by a few feet of rock, are exposed there. The middle one of these is only sufficiently uncovered to reveal its thickness. This one is nine feet. This mine is covered by what some miners call a rider, that is, rock lying nearly or quite flat, or hanging in a direction contrary to the dip of the ore and rock in which it lies. This rock roof covers this mine; after its removal, the ore and its walls lie conformably, that is, dipping to the southeast. The ore is mostly compact and hard, containing considerable sulphur, and requires roasting. It is associated with quartz, hornblende and mica. Preparations are making to use it extensively.

Long mine is about five miles southwest of Southfield furnace, and two and a half miles west of the saw works. This mine has been known since long before the revolution, and is the only one in the county at which any thing like systematic mining has been attempted. This ore has its bearing and dip corresponding with those of the rock. Only one layer of the ore has been worked, which is six feet thick. The ore is strongly magnetic, and said to be as good as any in the Highlands. It is associated with hornblende, sahlite, slaty gneiss, gneissoid hornblende and reddish granite—has a small quantity of pyrites—requires roasting, and gives a red short iron.

This mine has been worked 300 yards in length and about 40 in depth. The early working has all caved in; but fine pillars of ore sustain the hanging wall where the work has been recently prosecuted.

Vast quantities of ore have been taken from this mine without any appearance of its failing. It belongs to the Messrs. Townsend. Only one dyke has ever occurred in this mine; it was one foot thick, and made no change in the direction of the ore. It cannot now be seen—is worked 70 feet deep.

The *Patterson mine* is half a mile southwest of Long mine—ore very similar in all respects—makes excellent *red* short iron—is in the granitic rock. The ore is twenty feet thick—opened 150 feet long. About 10,000 tons of this ore have been used. It is strongly magnetic, and has polarity.

About the middle of the mine, as now open, is a transverse slip or *heave;* the mine and its walls appearing as if they had slid downwards and forwards to the southeast, causing an angle in their line of bearing. It is the property of the Messrs. Townsend.

Mountain mine, *Antone mine*, *Conklin mine* and *New mine*, are a group from twenty-five to fifty rods northwest and north from the Patterson mine, belonging to the same proprietors. They lie in nearly parallel beds; the ore of all apparently similar—a rich black magnetic oxide, possessing polarity. Ore to the amount of 5,000 tons has been used from these mines; the ore and walls nearly vertical; layers of ore from four to eight feet thick. The new mine has a cap of rock lying nearly horizontal; associated minerals, sahlite, hornblende, and feldspar. The sahlite is laminated and very beautiful; iron red short.

Crossway mine, upon the same estate, is 400 or 500 yards southwest of Mountain mine. This bed is 14 feet thick, and has been wrought 65 feet deep and 150 yards in length; ore and iron very similar to those of Patterson mine; moderately *red short;* ore and walls nearly vertical; 28,000 tons are supposed to have been used from this mine; associated minerals, hornblende, epidote, mica and adularia.

Sterling mines, belonging to the same gentlemen, are about a mile southwest from Crossway mine, at the south end of Sterling pond. These mines, or *this vast mine*, is in the northern end of a mountain of moderate elevation; its length is about three miles. The ore is *rich*, granular and compact; its product, *cold short* iron; is one of the earliest known iron mines in the United States. The minerals connected with this ore are crystallized green hornblende, sahlite, green mica, flesh-coloured feldspar, and the ore in octohedral crystals. The rocks are granite, and a coarse showy sienite. There is abundant evidence of great disturbance in the stratification in this mountain, and in all the vicinity. The rocks dip to the northeast and east, with the ore conformable to this arrangement; at least such is the general arrangements, so far as can be ascertained in this mass of confusion. The ore alternates with the rock; how often, cannot of course be ascertained. The ore lies naked about fifty rods wide by 150 yards in length. In many places its surface is even and polished as if it had been ground off by the sliding of the rocks.

The *Belcher mine* is upon the same property, and very similar ore to that of Sterling; it makes *cold short* iron. It is one and a half miles southwest of Sterling mines, and at the southern termination of the same mountain. The ore has been worked about 115 feet wide without finding a rock wall on either side. It is believed to be a prolongation of Sterling mine.

Red mine or *Spruce Swamp mine* is nearly three miles south of Long mine. All the ores of this mine are magnetic and full of pyrites, so much so that only a moderate amount has been used. They decompose rapidly when dug up and exposed to the open air. In this manner the surface of this mine has all been reduced to powder of an iron-rust colour; like several other mines the ore alternates with the rock.

Magnetic oxide of iron is also found of good quality in many places in Cornwall; but these have not been opened to much extent. Near the foot of Butter hill, on the land of Mr. Clarke, on Deer hill, on the land of Mr. Luke Wood, and that of Thomas Titus, are indications of valuable deposits of this ore.

Two and a half miles west of the village of Canterbury, in Cornwall, is the *hematite* or *limonite* mine of Mr. Thomas Townsend. For the last two years this ore has been considerably used, and although a lean ore it makes excellent iron. It is mostly in powder, or very small fragments, mixed with balls and pieces of the hematite, of a few pounds weight. It lies in limestone rock, and between the limestone and the grit rock. These rocks, where connected with the ore, are decomposed to great extent, and mixed in the state of powder with the ore; hence the ore requires washing.

This stratum of limestone and hematite can be traced across this town into Monroe, until we reach the magnetic oxides already noticed. It is seen a quarter of a mile north of the Clove mine, and at many places intermediate between this and the Townsend mine in Cornwall. The distance between these extreme points is full ten miles.

Hematite is also found along the whole western side of Bellvale mountain, and in places along the Warwick valley, to the New-Jersey line.

Thus it appears, that in Orange, one great iron region extends from the Hudson river on the east side of Butter hill quite across to Rockland county.

Another on the west side of Butter hill follows the valley across Cornwall, east of Skunemunk mountain, through Monroe, and by way of Sterling into New-Jersey, and far across that State.

The amount of ore in these deposits, which is of easy access, and has the most perfect facilities for cheap mining, is perfectly inexhaustible.

The amount of iron to be made in the county in all time to come, can only be limited by the supply of coal necessary for the reduction of the ores.

List of minerals observed in making the examination of the county of Orange, by W. Horton,

Magnetic	iron ore,	crystallized,	O'Neal mine,	Monroe.
do	do	do	Sterling	do
do	do	massive,		
do	do	do	O'Neil	do
do	do	do	Forshee	do
do	do	do	Sterling	do
do	do	do	Belcher	do
do	do	do	Crossway	do
do	do	do	Spruce swamp	do
do	do	do	Mountain	do
do	do	do	Patterson	do
do	do	do	Long	do
do	do	do	Greenwood	do
do	do	do	Rich iron	do
do	do	do	Horsen clever	do
do	do	do	Forest of dean	do
do	do	do	Clove	do
do	do	do	Green's mine, Deer hill,	Cornwall.
do	do	do	Titus' do	do
do	do	do	2 miles east of Warwick,	
do	do	do	Amity,	
do	do	do	4 miles SE Woodbury furnace,	Monroe

Magnetic pyrites, O'Neil mine, Monroe.
do do Rich iron do
Iron do in cubes, 2 miles southeast of Warwick.
do do cubic, Carpenter's point.
do do do 4 miles north of Newburgh.
do do massive Clove mine, Monroe.
do do do O'Neil do
do do do Greenwood do
do do do Rich iron do
do do do Forshee do
do do do Spruce swamp do
do do 2 miles south east of Warwick.
do do Sugar loaf and Snakehill, Goshen.
White do in crystals, Rocky hill, Warwick.
Skorodite drusy, Edenville.
Arsenical iron, massive, Edenville and Amity.
Brown and red hematite or limonite, in a bed 2½ m. W. of Canterbury.
do do do ¼ m. N. of Clove mine, Monroe.
do do do Bellvale, 4 m. E. of Warwick.
do do do near New-Milford, 3 m. SW do
Bog ore, Blooming-Grove.
do Goshen,
do New-Windsor.
Arsenical iron, Edenville,
do Amity.
Arragonite, Edenville.
do 1½ miles west of Newburgh.
do O'Neil mine, Monroe.
Satin spar, Blooming-Grove.
do 5 miles south of Goshen.
Brown spar, village of Warwick.
do 1 mile southeast of Warwick.
do Hampton 6 miles northeast of Newburgh.
Calc or rhomb spar, white, Amity.
do do red, do
do do white, O'Neil mine.
do do red and white, 2 m. E. Greenwood furnace Monroe.
do do 4 miles SE of Woodbury furnace.
do do do Two ponds, Monroe.
Iceland, 1 mile SW of Amity.

Quartz, crystals, Blooming-Grove.
do do Warwick.
do do Goshen.
Sulphate of lime, 1 mile NE of Edenville.
Phosphate of lime, crystalized, Amity and Edenville.
Hornblende, do Sterling, Monroe.
do do Two ponds, do
do do Amity.
do do Mount Eve.
do do 1 mile north of Edenville.
do do 1 mile NW do
do do 1 mile SE of Amity.
do do 1 mile south of do
do do 1 mile SW of do
Augite, crystals, Two ponds, Monroe,
do do Greenwood furnace, Monroe.
do do 2 miles SE of Greenwood furnace.
do do Fort Montgomery.
do do Edenville.
do do Amity.
Coccolite, 4 miles west of West-Point.
do Forest of Dean, Monroe.
do beautiful black, Forest of Dean, Monroe.
do Greenwood furnace, Monroe.
do 2 miles east of Greenwood furnace.
do 2 miles SE of do
do 1 mile west of Monroe works.
do Forshee mines.
do Amity.
do O'Neil mine, Monroe.
do Rocky hill, Warwick.
Sahlite, Forest of Dean, Monroe.
do " " mine, Monroe.
do Rich iron mine, do
do 3 miles SE Greenwood furnace, Monroe.
do Long mine, Monroe.
do Mountain mine, Monroe.
do Patterson do
do Sterling do
do O'Neil do
Scapolite, crystallized and massive, Two ponds, Monroe.

Scapolite, crystallized and massive, Greenwood furnace, Monroe.
do do 1½ miles north of Edenville.
do do Amity.
Meionite, Two ponds, Monroe.
do Forest of Dean, do
Boltonite, 2½ miles SE of Monroe works.
do Two ponds, Monroe.
do Forest of Dean, do
do 4 miles west of West Point, Cornwall.
do fine, 4 miles SE of Woodbury furnace, do
Mica, greenish white, Forshee mines.
do green, Clove mine.
do do Sterling mine.
do black, Greenwood Furnace.
do red, Mount Eve.
Zircon, brown, do
do red, Deer hill, Cornwall.
do do Amity.
do red and white, McGee's hill.
do black, Rocky hill, Warwick.
do do 1 mile NE Amity.
do red, 1 mile north of Edenville.
do black enclosed with white, Rocky hill.
Tremolite, green, 1 mile north of Edenville.
do brown, do do
do white, do do
do gray, do SW of Amity.
do white, do do
do " do do
do brown, do SE do
Pargasite, Amity,
do 2 miles NE Greenwood.
do Two ponds, Monroe.
do Forest of Dean mine, Monroe.
do 4 miles west of West-Point, Cornwall.
do do SE Woodbury Furnace, do
Idocrase, Amity.
do 1 mile SE of Amity.
do do south do
do do north of Edenville.
Sapphire, do east of Amity.

Sapphire, 1 mile south of Amity.
Oxide of Titanium, 1 mile SW of Amity.
do 1½ miles SE of Warwick.
Sphene, Amity.
do 1 mile SW of Amity.
do do NE of Edenville.
do Rocky hill, Warwick.
do 4 miles SE of do
do do Saw works, Monroe.
do Two ponds, Monroe.
Crichtonite, 1 mile south of Amity.
Spinells, 2 miles east of Greenwood, Monroe.
do black, Amity.
do do 1 mile south of Amity.
do do ½ do west do
do do 1 do north of Edenville.
do do Mount Eve.
do red, ½ mile SE of Amity.
do do do
do do 1 mile SW do
do gray, 1 do do
do green, do
do black, 2½ miles SE Monroe works.
do do Two ponds, Monroe.
do do 4 miles west of West-Point, Cornwall.
do do Forest of Dean, Monroe.
do do 4 miles SE Woodbury furnace, Monroe.
Clintonite,* Amity.
do 1 mile SW of Amity.
Warwickite, 1 mile south do
Serpentine, Queensborough, Monroe.
do Forshee mines, do
do 2 miles NW Sterling, Warwick.
do 1 mile south of Amity.
do do SW do
do do east do
do O'Neil and Clove mines, Monroe.

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* This mineral was first found by Dr. Horton, Mr. John Finch and myself, in the summer of 1828. We conceived it to be a new mineral, and gave it the name of Clintonite. It was afterwards described by Mr. Finch, under the name of bronzite, which he then believed it to be. It was afterwards called seybertite, and afterwards holmsite. As one of the original discoverers of the mineral, I claim the name originally given, in honor of our distinguished statesman, scholar, and man of science, De Witt Clinton.

W. W. MATHER.

Brucite, 1 mile north of Edenville.
do Amity.
do 1 mile south of Amity.
do do north of Edenville.
do every where, Amity and Edenville.
Tourmaline, 1 mile north of Edenville.
do do SW of Amity.
do Rocky hill, Warwick.
do yellow, 1 mile SW of Amity.
Orpiment, 1 mile north of Edenville.
Fluor, 1 mile east of Amity.
do do SW do
do do north of Edenville.
Plumbago, Amity.
do radiated, 3 miles SW of Saw works, Monroe.
Labradorite, 1 mile SW of Philipsburgh.
do Walkill.
do ½ mile NW Washingtonville, Blooming-Grove.
do Warwick.
do 4 miles south of Goshen.
Feldspar, red, Sterling mine.
do do Patterson do
do Two ponds, Monroe.
do Buttermilk falls, Cornwall.
do white, 4 miles west of West-Point.
do do Mountain mine.
do do Rocky hill, Warwick.
do red, Mc'Gee's hill.
do white, (adularia) 3 miles SE of Monroe works.
do crystallized, Amity.
do do Rocky Hill, Warwick.
do do 1 mile north of Edenville.
do do do east of Amity.
Kaolin, 1 mile north of Southfield furnace, Monroe.
Epidote, crystallized, 1 mile north of Southfield furnace, Monroe.
do do Long mine, Monroe.
do 4 miles SE of Warwick.
Lydian stone, Canterbury, Cornwall.
Jasper, red, yellow and black, Bellvale, 4 miles east of Warwick.
Chalcedony, white, yellow and blue, do do
Cacholong, do do

Galena, Fallbrook, Deerpark.
Pseudolite, 1 mile SW of Amity.
do do south do
Kyanite, Rocky hill, Warwick.
do 2 miles SE of Warwick.
do Queensborough, do
Fibrolite, do do
Talc, 1 mile SW of Amity.
do ½ do SE do
Cinnamon stone, 1 mile SW of Amity.
Garnet, 1 mile SW of Amity.
do O'Neil mine, Monroe.
do Two ponds. do
do 2 miles east of Warwick.
Asbestos, Mount Eve.
do Forshee mines.
do Clove mines.
Amianthus, Amity.
do O'Neil mine.
do Greenwood furnace, Monroe.
do Clove mine. do
Diallage, 1 mile south of Amity.
Chrome, crystallized in octohedrons Clove mine, Monroe.

The statements here subjoined are from Peter Townsend, Esq. one of the oldest iron masters of our country; he was born in the vicinity of an iron furnace, and has been engaged in this business during a long life, has introduced many improvements, and by his enterprize and industry has done much to benefit his country in time of need. He cast the first cannon in this country; he also put steel works in operation, and has long been a highly useful citizen.

Sterling mine—discovered in 1750, by whom unknown; named after Lord Sterling, the then proprietor of the soil; he sold, and a blast furnace was immediately put in operation by Messrs. Ward and Colton, that is, in 1751; cost of mining is 37½ cents per ton. Its yield is always 50 per cent in the blast furnace. Amount of this ore used has ranged from 500 to 2,000 tons annually; the medium of this gives 137,000 tons as the amount of ore used from this mine. At present the amount used is 2,000 tons; the ore always fuses easily; its iron is between *cold* and *hot* short; very sound and strong. It has been largely used for casting cannon and for making bar iron; no proper dykes in the mine, it lays on the side of a mountain. The ore, in different places where opened, is from 10 to 20 feet thick, inclining at an average angle of 30°. The floor is smooth granitic rock, a little over three feet thick; rests on another bed of soft rich ore, and the little used proves free of sulphur. (I may add from my own knowledge *positively*, that another immense bed underlays the last mentioned.—*Wm. Horton.*) Sterling mine covers a surface of more than 30 acres, by survey; part of this the ore is bare, part is covered by soil from one to five feet in depth, and part by rock, from six inches to a yard, or more, in thickness.

Long mine—discovered in 1761, by David Jones, has never been bottomed in any place. It is traced over a mile in length; is wrought 40 rods in length, general width 16 feet, consisting of two parallel layers, with a waving *slab* of rock between them from 4 to 12 inches thick. In this 40 rods a dyke has been found, of what Mr. Townsend calls an imperfect flint, 2 feet thick, standing perpendicularly, and crossing the ore at right angles, (it is now covered.) All the ore similar; yield always 62 per cent. Average amount of ore used 500 tons; this in 75 years gives 37,500 tons taken from this mine. Its iron is remarkably tough clean, and strong; cost of mining from 50 cents to $1 per ton. The iron of Long mine has been much used for cannon steel, muskets, wire and fine malleable iron. It has also been cast into harness buckles, and after annealing, proves exceedingly tough and strong.

Patterson mine—discovered in 1831 by John Patterson. 1,000 tons of this ore are used annually, which in 7 years gives 7,000 tons as the amount. Cost of mining from 50 cents to $1 per ton; yields 56 per cent. Its ore chiefly used to correct infusible and bad ores, such as O'Neil and lean hematite ores. Iron good.

Red mine, or *Spruce swamp mine*—discovered in 1780, by J. Stuperfell; cost of mining 50 cents per ton; ore sulphurous; being remote, not much used; iron sound; has been generally used as a flux, mixed with hard black oxides and refractory *cold short* ores; it assists fusion, and improves the quality of the iron.

Mountain mine—Discovered in 1758, by a hunter, in consequence of a tree being blown up by the roots; yield 45 per cent; iron remarkable for strength and *fine polish*; cost of mining $1 per ton. Two dykes cross this mine at an angle of 45°, each 15 inches thick. Before the revolution, when this mine was chiefly worked, the iron was sent to England to be used for tinning.

Crossway mine—Found in 1793, by John Ball; yields 50 per cent; iron good for casting, and malleable; none used last 30 years, mine being wet; cost of mining $1 per ton.

Antone mine—Discovered by John Antone; ore yields about 50 per cent. In all respects similar to Crossway mine, and is, in fact, the same continued; cost of mining $1 per ton.

Belcher mine—Found in 1792, by Jacob Belcher; ore yields 48 per cent; iron cold shot; cost of mining 37½ cents per ton; ore well adapted for making bar iron by the the blooming process, for which only it has been used.

The first furnace on this tract, at Sterling, in 1751, by Ward & Colton, used Sterling ore, until the discovery of Long mine. The first forge at Sterling in 1752, built by Abel Noble, from Bucks county, Pennsylvania. There have been two forges of eight forge fires.

Southfield furnace, now in operation, was built in 1806; its annual average of iron is 750 tons, and 225 bushels of coal to the ton of iron.

Sterling averaged annually 800 tons of iron, and it was made into 550 to 600 of bar iron.

Before, and during the revolution, the annual production of iron (pig) in this county, was 1,500 tons, and about 1,000 tons bar iron. From 1830 to 1838, there has been made annually in this county 3,000 tons of pig, but the bar has been diminished. Steel was first made on this tract in 1776, in the German manner, by the late Peter Townsend, Esq. Pig iron was first used for this purpose, and subsequently bar iron.—The first blister steel manufactured in the State of New-York was in 1810; it was made by the present Peter Townsend, Esq. from the iron of *Long mine*. It was used for edge tools, and proved equal to the Dunamore Swede iron, called hoop. The first anchor made in the State of New-York, was at Sterling forge, in 1773, from iron of Long and Sterling mines.

The great chain extended across the Hudson at West-Point during the revolution, was made at Sterling in March and April, 1788, by the late Peter Townsend, Esq. It was contracted for, and its making superintended by Timothy Pickering, Esq. The iron of this chain was made from equal parts of Sterling and Long mine ores; the weight of each link was from 140 to 150 lbs. and the whole chain 186 tons, made and delivered in 6 weeks.

The first cannon made in the State were by the present Peter Townsend, Esq. in 1816, from the iron of Long mine; they were 6, 12, 18, 24 and 32 pounders. *Not one failed* in the proof; some of them were light field pieces, all for the Government of the United States. The 6 and 12 pounders were made to order lighter than British brass field pieces of the *same size*, still the metal withstood proof.

Signed, **W. HORTON.**

(C.)

REPORT

Of L. D. Gale, to W. W. Mather, on the Geology of New-York county.

GEOLOGICAL SURVEY OF THE ISLAND OF NEW-YORK.

This island is about twelve miles long, and from a half of a mile to two miles and a quarter broad.

To give a clear view of the geology of the island, it will be necessary to state in general terms the character of the neighboring rocks, boulders of which there is good evidence to believe are found on almost every part of the island.

Taking the Hudson river as the dividing line, we have on the east, the island of New-York, and the southern portions of Westchester county, consisting of gneiss and its subordinate rocks, as *serpentine*, *hornblende*, *primary limestone*, *anthophyllite rock*, and perhaps a few others; while on the west in the contiguous State of New-Jersey, we have *red sandstone* in all its varieties; *serpentine*, *greenstone* in all its varieties, with the minerals usually accompanying these rocks.

The basis rock of the island is *gneiss*, if we except about one mile in length of the northern extremity, which is limestone. The middle and northern portions are rough and broken from the almost constant exposure of the rock above the surface; while the southern, although consisting of the same material, is every where covered, and in some places to great depths, with alluvial* and diluvial deposits.

The gneiss varies considerably in character in different portions of the island. For example, the northern part abounds largely in limestone; and the western in veins of granite and quartz; while the southern and eastern, as well as the middle portions, are more purely gneiss.

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* Whether some of these alluvial deposits referred to, especially the beds of sand found under the diluvium, are as old as the tertiary or not, I will not pretend now to determine.

The covering of the rock, in the southern part of the island, is in some places more than 100 feet in depth, and consists generally of from 10 to 80 feet of diluvium (loam, gravel, or boulders, one or all) on the surface, resting on the same or greater thickness of alluvial or tertiary sands, which last are highly stratified, and in many places even exhibit the appearance of ripples as from the retiring waves of the ocean. As we proceed northward, the deposits grow thinner and thinner, until the rock makes its appearance above the surface. This occurs on the east side of the island, between 13th and 16th-streets, and on the west, from 29th to 31st-street. The greatest thickness of diluvium is at the south-eastern extremity, where it was accumulated in conical hills, some of which were 70 or 80 feet above the grading of the streets. The general direction of the strata, corresponds very nearly with that of the avenues; and the dip, though generally to the west, averages within 10 degrees of vertical. In speaking of different sections, the dip, on the west side, more especially from the city to Harlem valley, is with few exceptions, vertical; and the same remark applies to the middle portions, as far east as to the Eighth avenue; while on the east side, from Fourth avenue to the river, the dip is quite irregular; varying from 45° west to 45° east; although the composition is more uniformly gneiss, than in other portions of the island.

In a few cases, it has been found that carbonate of lime enters into the composition of the rock of the island. This is the case on the east side of the Fourth avenue, from the 118th-street to the 120th-street. Here the rock retains its identity, as gneiss, to all appearance; although half of its mineral matter is carbonate of lime. Again, at 157th-street, and about 100 feet west of Tenth avenue, the rock is entirely changed, both in composition and structure. In composition, it is a mixture of limestone and serpentine; while in structure, it is destitute of strata, and lies in beds.

The following remarks will be arranged under seven heads, as follows:

1. Description of the region between the city of New-York and Harlem, and Manhattanville valley.
2. The region between the above valley and Kingsbridge, or from Harlem and Manhattanville valley, to the northern extremity of the island.

3. General remarks on the transported materials of the island, both alluvial and diluvial.
4. Alluvial beds or valleys.
5. Boulders; their abundance and sources in different sections.
6. Minerals enumerated. 1st. Those peculiar to the rock of the island. 2d. Those that have been transported.
7. Diluvial grooves and scratches.

I.

Description of the region between the city of New-York and the Harlem and Manhattanville valley.

The section lying between the settled portion of the city and the level valley extending from Manhattanville on the Hudson, to Harlem on the East river, is generally bounded on the south by the out-cropping of the gneiss, which as before stated, commences on the west at 31st-street on the 10th avenue, and at 29th-street on the 9th avenue, at 28th-street on the 8th avenue, at 24th-street on the 7th avenue, at 20th-street on the 6th avenue, and at 16th-street on the 5th avenue, where it comes within 4 feet of grading; on 13th-street, between University place and Broadway, it again approaches within three feet of the surface; and on 4th, 3d and 2d avenues, at their several junctions with 16th-street, it appears at or above the surface; while on the 1st avenue, it crops out first at 21st-street, and continues as we progress to the northward on the banks of the East river, until we reach 94th-street, which is at the eastern termination of Harlem flats, where the rock dips below the surface, leaving a salt marsh which from this point continues northward. Again commencing on the west side of the island, we find the rock continues from 31st-street northward to Manhattanville, almost constantly above the surface at or near the water's edge.

The elevated points of this section of the island vary from 70 to 120 feet above tide water mark, and will when graded, give at a rough estimate a medium level of about 40 feet above the contiguous waters. The valleys, however, are often deep, and the hills precipitous, rendering this section rough and broken.

The 3d, 4th and 8th avenues have been cut through until they reach the Harlem river; the first two terminate at Harlem, the other at McComb's dam; 5th and 7th avenues terminate at 21st-street; 6th avenue extends to the Bloomingdale road at 32d-street; 10th avenue to the same road at 70th-street, in the village of Bloomingdale; and 9th avenue terminates at 42d-street.

The excavations for the above avenues have rendered Geology an essential service by exposing the rocks of the island, and exhibiting their surfaces, their stratification, their mineral ingredients, and included minerals. The strata of the rock, as before stated, (page 178) follows more generally the direction of the avenues, which run north 35° east. Of about seventy-five observations on this section, to ascertain the strike of the strata, more than fifty gave results varying from north 25° east, to north 35° east, making the medium strike north 30° east. Two extremes were north 45° east, and north 45° west.

The dip of the strata was taken in eighty-four different places on this section. Of these, twenty-nine were vertical, thirty-eight were to the west, and eight to the east. Of the thirty-eight which dip westward, twenty-four are between 80° west and vertical, seven between 70° west and 80° west, and three between 45° west and 70° west. Of the eight which dip eastward, six are from 80° east to vertical, and two are 45° east. Of the eighty-four observations, fifty-eight were within 10° of vertical, and only six gave an eastward dip. The result is, therefore, that the medium dip of all the rocks of this section is westward about 85°.

The quality of the rock which forms the substratum of this section, does not differ much from that of other parts, whether north or south of it; therefore, with some few exceptions, a proper description of the rock as it occurs here, will answer for the whole.

As to its components, it contains a large proportion of mica, a small proportion of quartz, and still less of feldspar; but generally an abundance of iron pyrites, (sulphur and iron) in very minute crystals, which on exposure, are decomposed. The sulphur and the iron both take oxygen from the air, and the result is free sulphuric acid, copperas and iron rust. The first two combine in their agency to hasten the disintegration of the rock, and the third gives it a permanent ferruginous cast. In consequence of these ingredients, it is generally fissile, tender, and soon disintegrated on exposure, rendering it unfit for the purposes of building.

In some cases, the rock is so highly charged with pyrites, that on exposure for a few days in a dry season, it becomes covered with copperas in the state of an efflorescent powder, exhibiting the appearance of white frost in an autumnal morning. This phenomenon I have repeatedly seen on the rocks at the Hell-Gate ferry.

Besides the regular ingredients of gneiss, it occasionally happens that the mica is replaced, either wholly or in part, by hornblende; in which case its colour is rendered darker, it is more compact in texture, and columnar in its structure. This occurs on the 4th avenue, in the railroad cut at the south opening of the tunnel.

As before stated, (page 177) the gneiss on the western side of the island so abounds with veins of granite parallel with the strata, that in many places they constitute the chief material of the rock; and will, I doubt not, at a future day, be wrought for useful purposes. This has indeed been the case to some extent; many sloop loads of stone cut for culverts and other faced work on the Croton aqueduct, have been prepared from the material furnished in opening the 10th avenue, and delivered. It is a fair granite, specimens of which I have furnished and labelled " granite from 10th avenue, near 48th-street." The granite prevails more or less from 31st-street on the west side, and from 24th-street in the middle, to 60th-street on the north, and most of it runs out southwest of Bloomingdale road. I am fully convinced that in cutting through the streets and levelling the lots, a large amount of excellent building material will be furnished, and will be a source of profit at a future day.

The stone furnished for the aqueduct was delivered at the dock near the place of consumption, at \$1 or \$1.12½ per cubic foot, dressed for the work, which, I was informed by one of the contractors, was about the same as it would cost to get them out and put them in shape when equally good materials could be furnished on the spot. This circumstance is explained by the fact that those who furnish it were contractors with the corporation of the city for opening the avenues on the island, where they are paid a certain amount not exceeding \$1 or \$1.10 per cubic yard, for removing the stone out of the way, and are at liberty to make such use of it as they please. The cutting of the stone, therefore, after it is removed from the quarry, is the chief expense to the furnisher; this shows why it can be furnished at so low a rate. The amount paid by the corporation for removing loose earth, varies from 12 to 30 cents per cubic yard, according to the nature of the earth to be removed, and the distance to be carried to get it out of the way; the most common price is 18 cents, and the same price is paid for filling in valleys, whether with stone or earth; and if it is done by the load, as is frequently the case, nine cubic feet make a load for one horse.

Where rough stone are furnished for basements and other rough work, they are delivered at \$1.00 a load, so that contractors sometimes get pay for excavating, and also for the material excavated, expense for carting excepted.

The northern boundary of the above section will be more particularly described in the remarks on the Harlem and Manhattanville valley.

The anthophyllite rock of this section of the island will be described with the boulders, hereafter.

II.

Description of the section of the island lying between the Harlem and Manhattanville valley, and the northern extremity of the island.

This section commences on the east side of the southern boundary, at the northern limits of Harlem village, a few hundred yards northwest of Harlem bridge, and at about 134th-street, and on the west side of the island at the village of Manhattanville, at about 128th-street, and extends in a northeasterly direction to Kingsbridge, a distance of not far from five miles. This section, though rough and broken, is less so than the northern part of the last described. A considerable part of it is still covered with its native forests, though most of it is capable of tillage. The southern part extending northward as far as the ten mile stone, taken as a whole, is more level than the northern; but from the ten mile stone to the northern extremity, it may be considered as divided into three sections, the western, the middle, and the eastern. The western is a continuous ridge of gneiss from a quarter to half a mile in width, and from 60 to 100 feet above the waters of the Hudson. The middle is a long narrow valley commencing a little north of the ten mile stone, continuing northward to Kingsbridge, and descending most of the way; it is in this valley the great Kingsbridge road passes. This valley is lined abundantly with boulders of sandstone, greenstone, and white limestone, like that from Kingsbridge, with large quantities of sand and loam. On the western side of this valley, the rocks of the western ridge are very precipitous, being in many places 50 or 60 feet perpendicular. The third, or eastern section, lying directly east of the Kingsbridge road, and nearly parallel with it, is a ridge of gneiss of some elevation, though inferior to the first or western ridge; and is covered to a very considerable depth on its western slope with transported materials in which diluvial loam, and boulders of greenstone and white limestone are most numerous, though many other varieties are to be seen. The eastern face of this ridge is precipitous, and borders on Harlem river or the intervening marshes. It is lower and shorter than the western, dipping down below the surface in the vicinity of 198th-street and the 10th avenue.

From the 198th to 204th-street, on the Kingsbridge road, a narrow valley is formed by an opening through the western ridge, and extending from the Hudson to Harlem river, in a northwest and southeast direction. Through this valley vast masses of diluvial loam and gravel, with sand and pebbles and boulders, have been transported and piled up in conical hills east of the road, and on the northern slope of the eastern ridge, which is covered by abundance of boulders of limestone, granite, greenstone and sandstone.

At the northern part of this valley, and from thence to the northern extremity of the island, the road continues on the east side of the ridge, and in view of the East river, leaving all of the high grounds on the west. At this northern portion of the valley, and on the eastern slope of the ridge, the limestone generally called Kingsbridge marble commences and continues to Kingsbridge, a distance of nearly a mile and a quarter. This marble, which has been chiefly wrought for burning into lime, is mostly of the variety called granular limestone, and is so loose in texture that after exposure for a time to the weather it falls to pieces, becoming a kind of calcareous sand. It belongs to the gneiss formation, as is evident from the commingling of the two in many places throughout the course of the limestone. At the junction of the two rocks, and often for a considerable distance into the marble, it retains the structure of gneiss with the mineral matter of limestone; but where the matter becomes pure limestone, it lies in beds without stratification, or but obscurely stratified.

At the southern limit of the limestone, where it is from 50 to 80 yards in width, and about 100 yards west of the road, the strike is north 30° east, and the dip vertical. It is flanked on both sides by gneiss, and as it continues northerly in the direction of the strike or bearing of the strata, it widens until it becomes from 400 to 600 yards in width, and from 10 to 30 feet in height, forming a low ridge immediately west of the road, but east of the main ridge of gneiss which flanks the eastern shore of the Hudson, and which terminates at Tubby Hook, about half a mile north of the commencement of the limestone. As the gneiss runs out at the mouth of the Spuytenduyvel creek, the whole ridge northward is limestone, the form and extent of which may be learned by inspecting the map of the island, where it is encircled in pencil mark. The strike was examined in a number of places on the ridge of limestone, and varied from north 25° east, to north 45° east, and the dip from 50° east to vertical. From Mr. Dykeman's house, which is near the southern line of the limestone, to the old tide-mill, (which is nearly opposite to Tubby-Hook,) at distance half a mile or a little more, is a line of abandoned quarries, which many years ago were extensively wrought for burning into lime; but as the lime was of inferior quality, other varieties at length superseded it. This limestone has been called dolomite, but whether from its granular structure, or from its composition, I am unable to determine. I have not met with any analysis of it, nor do I think there is any on record.

The individual minerals, and the diluvial furrows, will be considered in another place.

The extreme eastern part of this section lies east of the three divisions already considered, and is bounded east and north by the Harlem river, west by the valley of the 8th avenue, and on the south by Harlem and Manhattanville valley. It terminates on the north at McComb's dam, about one mile north of the Harlem bridge, and consists of a low ridge of gneiss, following the line of the 7th avenue. It is from 200 to 400 feet wide, and from 50 to 80 feet above the contiguous plains. The valley through which the 8th avenue passes, is throughout its course a perfect level, and but a few feet above the waters of the river. The strike of the strata of this ridge at 142nd-street is north 25° east, and the dip vertical. In the extreme north, at McComb's dam, the gneiss crops out. It has the strike north 35° east, and the dip vertical; and is covered in many places to the depth of 15 or 20 feet with diluvium, consisting of loam, sand, gravel and pebbles, with boulders of white limestone, like that of Kingsbridge, greenstone like that of the Palissades, sandstone and granite. The granite is generally rough and angular; while most of the others, especially greenstone, are rounded and smooth. In this vicinity the general course of the river, as well as the valley through which it runs, is SSE, so that any current from the northwest would be likely to accumulate any materials swept along in its course on such prominences as that at McComb's dam.

III.

General remarks on the transported materials of the island, both alluvial and diluvial.

The island contains in every part abundant evidence of a current having swept over it from northwest to southeast, both from the grooves and scratches still visible on the solid rocks of the island itself and its vicinity, and from the materials themselves being traceable to the original rocks, whence they have been transported. The southern part of the island contains the largest amount of these materials. In the south-eastern extremity of it, usually denominated Corlear's hook, the surface has been graded in some places 70 or even 80 feet below the natural level, and shafts have been sunk 75 or 80 feet more without reaching the rock. The diluvium and alluvium together are therefore in this vicinity at least 150 feet, the streets having been graded in some places half that depth below the original soil. It is proper to state that the whole of Corlear's hook and its vicinity originally consisted of a series of conical hills of diluvial sand, gravel and pebbles, with masses of all sizes, from pebbles to boulders 15 or 20 feet in diameter; all of which have been removed and deposited in the neighboring valleys and low grounds. Here were collected, not only the largest quantity, but the greatest variety of rocks that were found in any part of the island.

We will now enumerate the different depths at which the rock has been reached by borings for water, or for other purposes, in different parts of the island which are covered by alluvium or diluvium. Most of these borings were commenced in this city many years ago by Mr. Levi Disbrow; and the same business is successfully conducted by his son, Mr. John Disbrow, from whom most of the subjoined facts were obtained.

Commencing at Corlear's hook, we find a shaft was sunk at Mr. James P. Allaire's works, in Cherry-street, about 80 feet through diluvium, stratified sands, clays, or gravel, without reaching the rock. Again to the westward about half a mile, at the foot of Jefferson-street, the rock was reached through 10 feet of diluvium, and 40 feet of stratified sands, and gravel alternating with clays.

At Fulton market a shaft was sunk through 15 feet of artificial ground, then 115 feet of stratified sands, blue clay and river mud alternating, and the rock was struck at the depth of 130 feet.

At Holt's Hotel, a few rods north of the last mentioned place, a shaft was sunk through 126 feet of strata like those at the market, and the rock reached through a bed of gravel, and the shaft sunk 500 feet into the rock, which is gneiss with veins of quartz and granite; 200 feet of the upper part of the bore is a three inch hole, and the remainder two and a half inch. The water obtained from this well was at first tolerably good, and promised to be very serviceable, but since has very much deteriorated, and is now said to be even more saline than that of the neighboring river.

On the west side of the island, at Washington market, which is on the west side of Washington-street, between Fulton and Vesey-streets, a shaft was sunk 10 feet through artificial earth, 50 feet through river mud containing decayed vegetable matter, sands, clays, &c. in thin alternating strata, 10 feet of sands and gravel, when the rock was reached at 70 feet from the surface.

Again, at the corner of Grand and Wooster-streets, a shaft was sunk 40 feet through artificial earth, then 20 feet of mud, clays, and sands highly charged with decaying vegetable matter; then 6 feet of fine blue clay; and lastly, 6 feet more of coarse sand and gravel, when good water being obtained, the borings were discontinued at the depth of 72 feet from the surface. This depth was considered as at, or at least as very near, the surface of the rock, from the fact that in almost all cases where the rock was reached at great depths through similar strata, it was found covered with a bed of gravel or sands, like that above mentioned.

In College place, directly north of Columbia College, which is on more elevated ground than the market, the rock was reached at the depth of 80 feet, through 20 feet of diluvium and 60 feet of stratified sand and gravel alternating. If we follow the high range of grounds in a longitudinal direction, as in the neighborhood of Broadway, though we have fewer data from which to judge, yet it is believed that the rock here approaches nearer the surface than in the places above mentioned. This is inferred from the fact that the direction of Broadway corresponds with that of the strike of the strata, and is generally more elevated than the grounds on either side of it, and the contour of the rock follows, it is believed, that of the loose earth which covers it.

At the old rock well near Trinity church, the shaft was sunk 26 feet through diluvial gravel and sands, where the rock was reached, though not penetrated, and good and permanent springs of water obtained. At the City Hall the shaft was sunk 90 feet to the rock, but is in the district of the Collect, (see vertical section No. 1.) The celebrated well, corner of Bleecker-street and Broadway, is 448 feet deep; 42 feet through stratified sands and gravel, and 406 feet in solid rock, having the usual character of the gneiss of the island. The bore of the shaft is 7 inches diameter, and yields 120,000 gallons in 24 hours, according to the statement of Mr. D. senior, who made the borings, and who also states that the water rose within 30 feet of the surface.

The shaft of the city reservoir in 13th-street, a few feet east of Broadway, is 113 feet deep and 17 in diameter, with 2 adits at bottom, one 75, the other 100 feet long. The rock was reached at about 20 feet.

In the same street, a few rods west of Broadway, the rock was reached at the depth of about 3 feet, approaching in one place very near the level of grading. At 16th-street, corner of 2nd, 3rd, and 4th avenues, the rock appears, and the soil as we go northward continues to grow thinner and thinner.

As we approach the East river from any point in the middle of the island, between 1st and 20th-streets, the rock dips down to a depth of 90 or 100 feet below grading, as evinced in the shaft sunk in this part of the city. In conclusion, the diluvium and stratified sand and gravel, it appears, extends on the west side of the island as far as 31st-street, and on the east side to 16th-street; and notwithstanding this formation is found in every other section of the island, it is in comparatively small quantities and needs not a particular description. The mineral character of these materials will be noticed in the description of the boulders.

IV.

Allvial Beds and Valleys on the Island.

There are three principal beds or valleys of alluvium that demand particular description. The first lying in the very centre of the city, includes nearly the whole length of Centre-street with Elm, on the west, and Orange and Mulberry-streets on the east, to the neighborhood of Canal-street. This valley was formerly called the Collect, as it was a receptacle for the draining of the adjoining higher grounds. In some portions it was a mere quagmire, and in others a collection of stagnant water 50 or 60 feet deep, and is said by some of the oldest citizens to have had an outlet communicating with the East river along what is now called Roosevelt-street; and another, with the Hudson across the Lispenard meadows, crossing Broadway at what was then called the stone bridge, (now corner of Broadway and Canal-street.) The Lispenard meadows extended from Broadway to the Hudson, and from the vicinity of St. John's church to Spring-street on the north, including the range of Thompson, Laurens and Wooster-streets.

This first valley being a fresh water alluvion, and a quagmire originally, was of great depth, as has been recently proved by soundings made by Mr. Disbrow, in the place now occupied by the Halls of Justice in Centre-street, between Franklin and Leonard-streets, where iron rods were sunk 40 feet through artificial earth, 30 feet through black mud, 5 to 10 feet of blue clay, then a bed of gravel resting on the rock. Still farther south, at the Manhattan water works, on Centre, between Reade and Duane-streets, seven shafts were sunk 30 feet each in coarse diluvial gravel without reaching the rock. The water supplied by the Manhattan company is by no means the best in quality, but is used for want of better in culinary operations in a considerable portion of the southern part of the city.

The black mud brought up from the lower part of the strata of the Collect was as salt as the waters of the river, though very good water was obtained at a higher level on the outskirts of this valley. This fact is generally explained by considering the water from the gravel beds bordering on the valley as that drained from the surface of higher grounds; while that from lower strata, as from the black mud above mentioned, was derived from the river either directly or indirectly, and being heavier retained its place at the bottom.

The second alluvial valley lies on the east side of the island, and includes what was formerly called the Stuyvesant meadows, and all the low ground extending southward to the vicinity of Corlear's hook, or from 21st street on the north to Delancy-street on the south, and from the river on the east to about half a mile westward; this last boundary varying somewhat in its distance from the river in different portions of it. This region is throughout a salt marsh, and was formerly to a considerable extent covered by the tide at every flow, but is now shut out by dykes and filling in of the streets. The strata composing this alluvion are mostly alternations of sands, clays and mud, and beds of sand or gravel resting on the rock, which last is from 90 to 100 feet below the grade level surface.

The following are some of the results of borings made in this alluvial district. At the corner of Fifth-street and Avenue D, a shaft was sunk which reached the rock at the depth of 109 feet.

At the Dry Dock another was sunk, which came in contact with the rock at the depth of 130 feet, and penetrated it 200 feet.

At the corner of Houston and Lewis-streets the rock was reached at 94 feet. At the corner of Houston and Avenue D, at 96 feet, and at the corner of Seventh and Lewis-streets the rock was reached at 93 feet. And at the corner of Seventh-street and Avenue D, it was reached at the depth of 100 feet. In these borings it is evident that the rock dips down on the east side of the island to about 100 feet below the grade level of the streets, and that about the same depth of alluvial deposits have accumulated, and most of them below tidewater mark.

The third bed of alluvium is that already referred to under the name of the Harlem and Manhattanville valley; the form of which approaches that of a scalene triangle, having the longest side on its southern borders, and extending from the village of Manhattanville on the Hudson to the termination of 94th-street on the East river; its shortest side from Manhattanville to the northern limit of Harlem village, near 130th-street; and the remaining side from the last named point on the north to the termination of 94th-street on the south. The width of the island at this place is about two and a half miles, and the length of the valley east and west the same, while its extent north and south is about two miles. The strata throughout the valley are alternations of sands, loam and gravel, generally in strata, but sometimes in conical hills thrown together in great confusion; and when this is the case, it is gravel and pebbles rather than sand or loam. The gravel and pebbles predominate towards the western portion of the valley; sand and loam in the eastern. Boulders are less abundant in this than in most other portions of the island.

Comparatively few excavations or borings have been made in this valley, consequently we have fewer data for determining the depth of earth covering the rock. In the northern part of Harlem village at the corner of 4th avenue and 129th-street the rock appears, and has been removed by blasting; and in a number of other places in the vicinity it approaches the surface or within a few feet of it; indeed it is inferred that the whole valley is a bed of alluvium comparatively shallow, inasmuch as the rock appears from 10 to 20 feet above the surface, both to the north and south of the valley, and immediately on its borders.

The extreme eastern portions, and especially the southeastern parts, are a salt marsh, which, along the borders of Harlem creek, approaches the 3rd avenue; but as few, if any, excavations have been made in it, little can be said of its geology.

Besides the above mentioned alluvial beds, others are found in different portions of the island, but they are so inconsiderable as to require no particular description.

There is, however, a prolongation of the Harlem and Manhattanville valley, which extends northward and embracing the 8th avenue till it strikes the Harlem river at McComb's dam. It consists generally of sand and diluvial loam, and is almost a perfect level; few boulders are to be seen on its surface, except on its northernmost part, where they are found in great abundance.

V.

Boulders—their sources and abundance in different parts of the island.

The following are the principal varieties of rock:

1. Greenstone in all its varieties.

2. Red and gray sandstone, and their varieties.

3. Serpentine like that at Hoboken.

4. White primary limestone like that at Kingsbridge.

5. Granite and gneiss like that found on the island.

6. Hydrous anthophyllite like that found in place on the west side of the island.

7. Greywacke like that found in the valley of the Hudson above the Highlands.

8. Limestone like that of the Catskill mountains.

9. Ferruginous sandstone or jasper rock, like the sandstone underlying the Palissades near Fort Lee.

10. Clay stone, supposed to be from the same source as the last.

11. Actynolite, supposed from the anthophyllite locality.

12. Kyanite—this has been found in small fragments, but I am not aware that it has been traced to its locality.

The abundance of the several varieties of rock above enumerated, is very different in different parts of the island. While some are common to every section, others are confined to a particular part; thus, greenstone is found in boulders every where from north to south, and from east to west, while serpentine, like that at Hoboken, is confined to the southern limits. The details of these facts will be found below.

1. *Greenstone.* This in all varieties is perhaps the most abundant rock that is not found in place on the island, yet in boulders is common to every part of it. In almost every instance, they are worn to a rounded form, though it is one of the hardest and toughest rocks known. They are among the largest transported rocks on the island, being from 10 to 15 feet in diameter, and often covered with grooves and scratches indi-

cating the mechanical violence to which they have been exposed. This rock is not found in place on the east side of the Hudson, but is the chief rock on the western shore, from Tappan bay on the north to Bergen hill on the south; and as all the varieties found in place there can be selected amongst the boulders here, the necessary inference is, that this locality is also the source of the greenstone. Specimens forwarded.

2. *Red sandstone*, like the greenstone, is common to every part of the island, being found from Corlear's hook to Kingsbridge, but most abundant towards the former place. These boulders vary considerably in appearance, as well as in size. Though occasionally consisting of coarse pebbles, they are generally fine grained, of a red or grayish red colour, and distinctly stratified. I have found some that measured 9 or 10 feet in diameter. This rock, like the greenstone which it accompanies along the Jersey shore, is not found on the island, nor on the east side of the Hudson nearer than the valley of the Connecticut.

There are two other varieties which I have referred to the red sandstone formation, but on account of their peculiar character as boulders, I will describe them by themselves under the name of ferruginous sandstone and claystone. Specimens forwarded.

3. *Serpentine*, like that at Hoboken, is common in the southern, but rare in the northern parts of the island. In speaking of serpentine, we shall make a distiction between that variety found in place at Hoboken, and that found at the anthophyllite locality on the island, which approximates to serpentine in character, but is harder and is mixed with limestone. These boulders are much more common in Brooklyn than in this city, except perhaps the region of Corlear's hook. This might be expected, taking for granted that they were transported from Hoboken, which seems to be a necessary conclusion, as no other locality of this variety is known in the vicinity. Besides, the direction of the diluvial grooves being from northwest to southeast is such as would carry the materials from Hoboken to Corlear's hook, and the east part of Brooklyn.

4. *White or Primary Limestone.* Boulders of this material were found some years ago in cutting away the hills at Corlear's hook, and in a number of places on the east side of the island, between the city and Kingsbridge; but I have neither seen nor heard of any being found on the western side. The principal places where I have found this rock, are on the 4th avenue near 120th-street; at the 7th avenue, north of the village of Harlem, near 142nd-street; at McComb's dam, at the

northern termination of the 7th avenue; and in a number of places in the valley of the Harlem river, between McComb's dam and Kingsbridge. Now the nearest locality where this rock is found in place, is at Kingsbridge, and I have no doubt the boulders in question came from this place; but had they been transported in the general direction of the current shown to be northwest and southeast, instead of reaching their present location, they would have been carried across the Harlem river, and have been deposited in the range of grounds lying about midway between Harlem and Westfarms. Specimens are forwarded.

5. *Granite and gneiss*, especially the latter, being abundant in every part of the island except the northern extremity, boulders of these might be expected to be more numerous than of any other materials; yet I think greenstone boulders are quite as numerous, take the whole island together, as granite and gneiss. The largest boulders I have seen of the latter kind, measured in diameter 12 and 18 feet, and are equally common in all parts south of the Harlem and Manhattanville valley. The granite, which exists in veins in the gneiss, is mostly on the west side of the island; and this when torn from its place and transported by a northwest current would naturally have been distributed over the eastern parts, and even as far as Long-Island. A number of very large ones were excavated between 1825 and 1830, in the vicinity of Corlear's hook, some of which were peculiar in character. One I well remember lay many years on the south side of East-Broadway, near its junction with Grand-street. It was a gray granite of coarse texture, with tabular crystals of black hornblende 3 or 4 inches in diameter interspersed throughout. It was 18 feet long, 16 broad, 8½ high. This is the largest boulder I have seen on the island, but those from 10 to 12 feet diameter are very common.

A large boulder of granite, 11 feet in diameter, and though somewhat rotund, has a rough and angular surface, as though it had suffered little from mechanical violence, rests on the gneiss rock on the east side of Bloomingdale road, from a quarter to half a mile south of the village of Manhattanville, and at the southwest corner of a Mr. Stevens' house, between it and the road. The whole rock on which it rests is covered with diluvial grooves, and a very large one 3 inches deep and 18 wide between the road and the boulder, and terminating at the latter, seems to have been the result of the movement of this huge mass. Specimens are forwarded.

6. *Hydrous Anthophyllite.* This rock has been familiarly known for many years in this vicinity under the name of *radiated asbestos rock,* but was known only as a boulder found in considerable abundance in various parts of the city, and as far north as 15th or 20th-street. Its geological place was not, however, known at that time; and as its true mineralogical character was somewhat doubtful, Dr. Torrey sent specimens of it to Professor Thomson, of Glasgow, who analyzed and pronounced it anthophyllite; but as it contained a much larger proportion of water than had usually been found in this mineral, Dr. Torrey proposed to prefix the term *hydrous*, which has been generally adopted. This rock has been found in place on the west side of the island, between 10th avenue and the Hudson, and between 57th-street on the south, and 63rd-street on the north. Here the strata are nearly vertical; the strike is NNE; the width of the bed at right angles to the strike varies from 3 to 30 rods. It commences at 57th-street, within 30 or 40 feet of the avenue, and runs obliquely to the streets crossing the 11th avenue near 60th-street, and runs out at the river on 63rd-street. It is remarkable that the granite lying on the west, and the gneiss on the east of the rock in question come in complete contact with it without intermixing. So remarkable is the line of separation on the side next to the gneiss, where there is the best opportunity to examine the two, that within the space of three inches each rock possesses all of its own peculiarities, with none of those of its neighbor. The mineral character of this rock varies much in different parts of the bed. In the southeast portion where it approaches nearest to 10th avenue it exhibits little or no stratification, is very dark coloured, and has a tabular structure. In the same vicinity are found masses of serpentine and limestone intermixed, exhibiting a porphyritic appearance, the serpentine appearing green and the limestone white. Again near the middle of its course, or near where it crosses the 11th avenue, it becomes lighter in colour, more fibrous and scopiform in structure; but the fibres are large, and in some instances approach the character of actynolite. Still lower down, following the strike towards the river, the same mineral character continues, except that the fibres are still finer, and the whole texture becomes softer and more like steatite; so that many years ago, before the rock was known to geologists, it was attempted to work this bed for a soapstone quarry, to be applied for similar useful purposes; but the material being too hard, the project failed. This rock has been found in boulders in all of the southern part of the island, and some are very large. On the west side they extend from the rock in place to 15th-street. In the middle division they have been found

from 48th-street on the north to 14th-street on the south, and on the east side from 24th-street to Corlear's hook.

On the south side of 14th-street, between Bowery and 3d avenue, is a boulder of this rock 15 feet long, 12 broad, and 6 high, containing on its surface abundance of diluvial scratches running longitudinally.

Again, 30 feet west of 3d avenue, on the south side of 16th-street, and 40 feet distant from it, is another boulder, 13 feet long, 8 broad, 7 high. It is uniform in texture, like that on 63d-street, in place, and is covered with scratches running longitudinally.

Another 12 feet long, 8 broad, and 8 high, is lying in 25th-street, about 20 rods west of 4th avenue, covered with scratches in every respect like those of the last.

Now had these boulders (which, I doubt not, have all been derived from the same rock,) followed strictly the course of the current indicated by the diluvial grooves on the island, they would have been found along the Bloomingdale road, near the 8th avenue, and from thence eastward to Kipp's bay and the alms-house, and possibly somewhat lower down; instead of which, they have been carried much farther south, to Corlear's hook, and even on Long-Island.

I will here remark, that I strongly suspect there are other localities of this rock eastward of this island; for boulders of the same character resembling most perfectly specimens of this island, have been found at West Farms, New Rochelle, and Sawpits, which could scarcely have been transported from the locality on this island.

7. *Graywacke*—Which is common in the valley of the Hudson. I have seen specimens found many years ago, in grading the streets at Corlear's hook. These specimens closely resemble the rock brought to this city for the purpose of flagging the sidewalks, from Coeymans and Coxsackie, also from Esopus creek, but as no specimens have come to my observation recently, or since about 1830, I cannot speak from personal knowledge.

8. *Limestone, like that of the Catskill or Helderbergh mountains*, abounding in *productus*, has been found at Corlear's hook, and in other places in the southern part of the island. I have a single specimen in my cabinet, obtained at that place in 1826, at the depth of 40 feet below the natural surface. It was then a boulder 2 or 3 feet in diameter, and has been distributed so that but a small fragment now remains. I

discovered it, and removed it to my cabinet, and considered it as bearing such strong evidence of its source, that I shall forward it to be preserved in the State cabinet at Albany.

9. *Ferruginous Sandstone or Jasper rock*, like that found in place underlying the Palissades, near Fort Lee.

This rock which is one of the most abundant next to greenstone and granite, in the south part of the island, I have not found north of the Harlem and Manhattanville valley. It is most abundant between 13th and 20th-streets, and between 2d and 4th avenues. This rock, when first noticed, was supposed to be a ferruginous quartz in a state of disintegration; but on a closer inspection, an obscure appearance of stratification was observed, and the component grains were found rounded and often transparent, and cemented together by a large amount of oxide of iron. In some specimens it is difficult to identify the granular structure on account of the abundance of the cement, and the advanced stage of decomposition in which it is found; in others, there is so intimate a union between the parts, that the whole seems to be one entire mass. There are others, again, where the cement puts on the appearance of jasper, and hence the name of jasper rock, which has frequently been applied to it.

In searching for the geological place of this rock, I am satisfied I have found it underlying the Palissades in the neighborhood of Fort Lee, where the red sandstone comes out under the Palissades very near the water's edge, and exhibits a great variety of character. Specimens of this rock are forwarded.

10. *Claystone*, supposed from the same formation as the last; they are distinctly stratified, and have a clay colour. They are often quite hard and slaty in structure. Specimens of this rock are forwarded.

11. *Actynolite*, supposed from the anthophyllite locality. This variety has been found in boulders at Corlear's hook, and in other places in the southern part of the island. One of 3 or 4 feet in diameter was discovered in 1826, near the corner of Monroe and Montgomery-streets. I preserved a single specimen, and remember distinctly the character of the whole mass; and on comparing the specimen in my possession with the varieties of anthophyllite in place, I doubt not that all the specimens of actynolite on the island have been transported from this source.

12. *Kyanite.* All the specimens of this rock that have come to my knowledge were in loose fragments lying on the surface, inferior in qua-

lity. I found two specimens in 1826 near Kipp's bay, but have heard of none more recently, nor have I been able to trace it to its geological place.

VI.

The Minerals enumerated : 1st. Those peculiar to the island. 2d. Those from other sources.

1st. Those peculiar to the island.

1. *Quartz Crystals.* (Inferior specimens,) small crystals in the Harlem rail-road cut under the track in veins of gneiss, about 122d-street.

2. *Rose Quartz.* (Inferior specimens,) from the same place; the locality being covered up no more specimens can be obtained.

3. *Epidote.* Very small crystals of a deep green colour, in hexagonal prisms in veins of half an inch wide in gneiss, at 38th-street, on the banks of the East river, in the southeast part of a gneiss quarry.

4. *Tourmaline.* In hexagonal prisms in granite beds or veins in various parts of the island. Many fine specimens were obtained in opening the Harlem rail-road.

5. *Brown Garnets.* With 24 trapezoidal faces, very imperfect; abundant in the gneiss on the shore of the Hudson, between 42d and 50th-streets, and in boulders in every section of the island.

6. *Hydrous Anthophyllite.* Already described, very abundant.

7. *Serpentine.* Intermixed with white limestone and of granular structure, described with the last, and from the same locality.

8. *Red Stilbite.* In small quantities in veins of gneiss; in small scopiform fibres of a reddish yellow colour. From the rail-road cut near the tunnel. The locality is exhausted.

9. *White Pyroxene.* In four sided tables in veins in limestone at the abandoned quarries at Kingsbridge, at about 208th-street, five rods west of the Kingsbridge road.

10. *Fetid Feldspar.* Of a bluish white colour, in tabular masses in limestone at Kingsbridge, Thompson's quarry near 196th-street, and about 100 yards west of the road.

11. *Iron Pyrites.* In exceedingly small cubic crystals throughout the island, in the gneiss and in the limestone at Kingsbridge.

12. *Tremolite, white.* In the abandoned quarries of limestone at 208th-street, west of Kingsbridge road.

2d. Those from other sources.

1. *Mesotype.* In cavities and veins in greenstone.
2. *Datholite.* From the same source.
3. *Apophyllite.* Also from same source.
4. *Chlorite.* Same source, found in small quantities.

All of this last class have been found in small quantities in veins in the boulders of greenstone, barely sufficient to determine their characters.

VII.

Diluvial grooves and scratches.

From the preceding remarks on the transported materials of the island, and from observations on the geology of the vicinity, it is quite certain that an immense force has been in action at a former period and has carried a vast amount of mineral materials from their original beds, and spread them over a large area. That water was in some way the agent is the united opinion of geologists, but the circumstances attending it, the immediate cause or causes of its movement, and the precise epoch in which it took place, it would be difficult, if not impossible, in the present state of our knowledge, to determine.

My remarks will therefore be confined rather to the force and direction of the current than to the causes which produced it.

The direction of the current is ascertained by that of the grooves and scratches left on the solid rocks; and its force, by the size and quantity of the fragments, and the distance and elevations over which they have been transported.

The term *grooves*, as here used, applies to all the furrows that are an inch or more across; the term *scratches* to all those less than an inch across; the word *furrow* without reference to size, but as a general term.

Diluvial grooves and scratches have been found in every section of the island, from 16th-street on the south, to 200th-street on the north, (or to the southern termination of the limestone,) and from the banks of the Hudson on the west, to Harlem river on the east.

The furrows generally are most distinct where the rock has been recently uncovered; and least so where it has long been exposed to the action of the elements. They have been found on the highest rocks, and at the lowest tide water marks, being a difference of more than 100 feet perpendicular height. It is evident, therefore, that if these furrows were the result of a single diluvial action, or a single deluge, the current was more than 100 feet in depth. The furrows are always most strongly marked on the northwestern slopes of the hills, and least so on the southeastern. In many instances they are very distinct on the western and northwestern slopes, extending to the highest point of the rock, but no traces are to be seen on the eastern and southeastern slopes, although both slopes are equally exposed.

Direction of the Furrows. Observations of the diluvial furrows were made in between sixty and seventy different places on the island. Taking together the whole series of observations, the general course of the current was from northwest to southeast, or north 45° west, but varied in the extremes from north 25° west to north 48° west, making a difference of 23°.

Of the whole series of observations, thirty-nine were north 45° west, twelve varied from north 25° west, (seven being north 35° west,) two were north 48° west, and a few scattering ones, varying from north 35° west to north 45° west.

Abundance of the Furrows. The furrows occur most abundantly in the middle portions of the island, between the city and the Harlem and Manhattanville valley, somewhat less in the western, and least of all in the eastern.

Direction of the Furrows in particular neighborhoods. Half of all the places where the furrows were noticed were in the middle portion of the island in the line of the 8th avenue from 60th-street to 105th-street, where without exception the direction is north 45° west. About one-fourth of all are on the west side, and vary but little from north 35° west, and about one-eighth on the eastern side, where the direction varies from north 25° west to north 35° west. In connection with this subject, I have examined the surface of the greenstone on the neighboring shores of New-Jersey, and find their grooves and scratches abundant, and their general direction is north 45° west. Hence it appears, that the diluvial current which once swept over this island from northwest to southeast, on reaching the western shore was deflected southward, as by the action of some force at a right or some other angle to its course; and that the same current, before it reached the middle of the island, again assumed a southeasterly direction, but was again diverted southerly on approaching the eastern shore. That some portion of the current was diverted southerly on reaching the western shore of the island, is evident, not only from the diluvial furrows, but from the boulders of anthophylite found in large numbers in the lower part of

8th avenue near 15th-street, a distance of two miles in a SSW direction from the only locality whence they could have proceeded.

Again, the white limestone of Kingsbridge has been distributed along the eastern shore of the island, in a direction almost due south of the only locality in the vicinity where it is found in place; whereas had they been carried in the general direction of the current, they would have been deposited eastward in Westchester county, as before stated.

Magnitude of the Furrows. The size of the furrows varies in the same and in different localities. Sometimes they are the finest scratches, not more than a line in diameter horizontally, and of the smallest appreciable depth; from this they increase to grooves 4 inches deep and 18 inches in horizontal diameter. In a few cases, they are furrows, or rather troughs, more than 2 feet wide and 6 or 8 inches deep. A case of the latter kind occurs on 8th avenue, between 79th and 81st-streets; and one of the former on the west side of the island, on the very banks of the Hudson, 500 yards north of Mr. John H. Howland's country seat, (near 97th-street.)

Convenient places for examining the Diluvial Furrows. The nearest places to the city for examining the furrows are at the junction of 22d-street and 1st avenue, south of the alms-house yard; and again about half a mile northward at Kip's bay, at the junction of 1st avenue and 35th-street. Both of these localities will soon be destroyed by grading the streets.

Some of the most interesting localities have been made known by cutting through 8th avenue from Bloomingdale road at or near 60th-street to Harlem and Manhattanville valley, at 105th-street. These localities are on both sides of the avenue, and very conspicuous.

Another, equally interesting in many respects, is on the banks of the Hudson, west of the Bloomingdale road, about six miles from the city, and about 600 yards northwest of Burnham's hotel.

The interest excited by this locality arises from the fact, that the furrows ascend from beneath the lowest tide water up an elevation of 70 feet in 300 or 400 feet distance, requiring a force greater than that of any current with which we of modern days are acquainted.

Respectfully submitted,

L. D. GALE,

Assis't Geologist First District N. Y.

THIRD ANNUAL REPORT

Of E. Emmons, of the survey of the Second Geological District.

To his Excellency, William H. Seward,
Governor of the State of New-York:

Sir—Owing to many inaccuracies in the county maps of the Second Geological District, and to the incomplete state in which the original surveys which constitute the foundation of those maps were left, especially that portion of the section which embraces the origin of many of the great water courses of the State, I was directed by his Excellency, Wm. L. Marcy, to attempt those corrections and supply those deficiencies, which are of the most importance to the geological survey.

This additional duty, while it has interfered with, and retarded, to a certain extent, the prosecution of my appropriate labors, has not caused at any time their entire suspension. The consequence has only been, that I have not been able to complete the examination of so much territory as I should have done had my attention been directed solely to the collection of geological facts.

It remains to be shown in the final result whether this course was judicious, though it can hardly be doubted that it is important that the proposed geological maps should be as full and accurate in geographical details as possible.

During the first season of the survey, Mr. Hall and myself ascertained the fact that by far the most elevated portion of the State is situated in the Second Geological District.

This circumstance gave an unusual interest to this section, and has induced already many gentlemen to visit this region of mountain; and it will undoubtedly in a few years become a favorite place of resort to persons of leisure. The location, too, of the Adirondack iron works, in the heart of this district, is a matter of great interest to the public, forming the nucleus of a great establishment, which will in a few years change the entire character of this region. Anticipating such a result, I was early induced to give topographical observations a prominent place in my labors; and I have been urged on by the consideration that this field is the great water shed from which flows in all directions, the waters of one-half of the State, and that it embraces a range of mountains whose peaks overtop by some 2,000 feet the great Catskills, widely famed as the Alps of New-York.*

Besides the importance of possessing correct geographical and geological maps, considerations connected with science in general have had their influence in directing my attention to the topographical features of the section committed to my charge. These in their aggregate, it is believed, will overbalance any loss which the geological survey will sustain in consequence of a partial diversion of labor in this particular.

It will be unnecessary, as I conceive, to give a detailed account of the measures adopted to accomplish this object. I deem it sufficient to say that I have been able to determine the position of the highest mountains in Essex, Warren and Hamilton counties, together with the course or bearing of the Northern Highlands, the zone or belt which they traverse, and the points at which the subordinate and primary range terminate.

To obtain my results, I have been obliged to travel over more territory than would have been required to have completed the necessary geological observations; hence my labors have increased; but that no lack of service might appear at the close of the survey, I have felt the necessity of improving every favorable moment for observation.

In selecting the subjects of discussion for the third annual report of my district, I have determined to confine myself to a few topics, and mostly to those of a practical kind, or to those most useful to the producing classes of community; though it is difficult to avoid the discussions of theoretical points when they appear in connexion with economical geology; and besides, it is often the case that those very points are of more value than the insulated facts from which they are inferred, inasmuch as they may lead to the establishment of general laws. For instance, I established the fact clearly in my first annual report, that the boulders of hypersthene rock which are scattered over the surface of the soil in Orange, Schoharie and Montgomery counties, could be traced to their parent rock in Essex county, from which I drew the inference that the current which transported those boulders flowed from north to south. The practical application of the inference is, that when searching for mines of iron, lead, coal, &c. by fragments of the veins or beds which have been more or less broken up by violence, we are always to proceed from south to north under the guidance of those fragments. The value of this inference is supported and confirmed in numberless instances.

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* In a report to the Legislature this present session, Mr. E. F. Johnson, the engineer of the Ogdensburgh and Champlain rail-road questions the accuracy of the measurements of Mount Marcy. In reply to his suggestion, I shall merely remark that it is quite doubtful whether the mountain in question is distinguishable from those of the same group, especially by one who has never visited the interior of this section; and if visible, his measurement is not entitled to consideration except as a very imperfect approximation.

Considering agriculture of the first importance to a State and community, we are gratified with every discovery which favors its prosecution and increases its products and profits.

Next in importance are those which increase the quantity of the raw materials for the use of the arts, the manufacturing of which employs directly or indirectly a large portion of the human family. Upon the abundant and cheap supply of those materials, much depends for the prosecution of the great system of internal improvements, the profits and success of which are, in a great degree, dependent on the Geological Surveys now in progress.

Last, though not the least in importance, are those discoveries of a scientific nature, which form the data on which natural phenomena are explained, and which constitute the basis on which may be founded the early history of the earth.

The latter, too, afford the most rational means for gratifying the curiosity of inquiring minds on subjects which relate to events of the greatest magnitude and importance, and which at present are regarded by the good and great, as entitled to occupy a high place in the instruction of youth, and as well calculated to preserve and improve the morals of community.

With these preliminary observations, I shall proceed to the discussion of the principal subjects of this report.

Porcelain Clay and Feldspar.

Among the natural productions of the Second Geological District, are *porcelain clay* and *feldspar*. Both substances are valuable, as they form the essential materials in all the finer kinds of pottery. They are at least the most important elements in the China, French and English porcelain; they also enter into the composition of the common Liverpool ware, but in a smaller proportion than in the French or English porcelain.

These substances occur at many localities in the United States, but generally they are not sufficiently pure and free from colouring matter, to render them objects of value; especially is this the case with *feldspar.* It is abundant, but contains frequently too large a proportion of the metallic oxides, which in the process of fusion, imparts colour to the glazing or enamel, a circumstance which entirely destroys its utility and value in this art.

The localities of porcelain clay which fell under my notice, were in Athol and Johnsburgh, in Warren county, and Minerva, in Essex.

The mode in which it occurs is in layers more or less distinct, or in layers interlaminated with those of different colours, as yellow, red and brown. At first view, they might be mistaken for ochre beds; still the peculiar reds and browns are entirely different from the oxides of iron generally termed ochres, and their nature becomes apparent from their association with the white variety.

It is remarkable, that the latter which is in the midst of the coloured portions of the bed, should have been deposited without any intermixture of the oxides so strongly developed in the adjacent portions.

Its colouring matters, I find, consists of a mixture of the oxides of iron and manganese.

The white variety is soft to the touch, and free from that harsh and meagre feel common to some varieties of this species of clay. This peculiar soft feel is owing probably to an intermixture of talc which occurs in it in the form of thin white scales.

My opinion of the excellent quality of this clay has been confirmed by an experienced artist, D. Henderson, Esq. of Jersey City, who has been engaged for a number of years in the manufacture of the blue or Liverpool ware. It is but just to remark, that at this establishment was made the first dining plate in the United States, and that the beauty of the articles now manufactured at this establishment is equal to any of the imported wares from Liverpool.

It is impossible to speak at the present time of the quantity which those localities will probably furnish. I was able to expose only a small portion of the beds which I visited; it would not be safe to make any estimate on those partial excavations. There are circumstances, however, which are favorable to the general impression which prevails in that vicinity, that the substance is abundant. One or two facts in particular, go to corroborate this position; for instance, its occurrence in numerous places, and which are scattered over an extent of country of 15 or 20 miles in length. It would be an anomaly, if throughout so much territory, there should not be an abundance of this valuable material.

This variety of clay is produced by the disintegration and decomposition of granite. Those granites, which are of a coarse texture and contain large lamina of mica, or are intermixed with scales of talc, are the most subject to this change. In the granite of Athol and Johnsburgh, there is more or less of pearl white talc, an association which I consider an advantage to the clay; its presence will increase the fusibility of the silex and alumine, and impart a rich porcellaneous aspect, or a greater translucency to the body of the ware; besides it adapts it for glazing and forming enamels for the common earthen ware, even if it is not employed for the production of the finer varieties of porcelain. In fact, it is of great importance that other materials besides salt, lead and the metallic oxides should be employed for glazing even the commonest articles of pottery, and the discovery of some substance which may be used as substitutes for those oxides, which are so readily acted upon by the weaker acids in domestic economy, has long been a desideratum. It remains, therefore, only to determine the truth of the conjecture, that of its abundance, to render it an important addition to the natural resources of the State.

The porcelain clay beds furnish us with some geological facts which are worth at least a passing notice. I found that they all contain concretions of silex, and of the oxides of iron and manganese.

The silicious nodules belong to the same variety of quartz which is usually denominated hornstone, and like this substance, often contains cavities lined with crystals of quartz, some of which appear under the primary form of the species, a form much sought for and esteemed by mineralogists on account of its variety. They are small, and only large enough to be seen distinctly by the naked eye.

The concretions are evidently masses of secondary formation as it regards the bed in which they occur; and their appearances, together with the circumstances connected with their position, are such, that we are obliged to consider them as having been once in solution. Chemists are familiar with the fact that water under certain circumstances freely dissolves silex; besides, it is well known that it is held in solution in the hot springs of Iceland, St. Michael's and many others in the vicinity of volcanoes; still, it is an insoluble substance after it has been once separated from water by precipitation, though in a state of minute subdivision. Again, silex becomes soluble by the assistance of the alkalies, potash and soda, especially when aided by heat. But the conditions under which it occurs in those beds are such, that no satisfactory rationale offers itself in explanation of its solution. The following is the only one which occurs to my own mind, viz: that the silex is derived from the feldspar, and that by its union with the potash it becomes soluble, either in the water of crystallization or of absorption, forming at one stage of its decomposition a silicate of potash; this compound, by subsequent reactions, suffers an entire separation of its elements, which finally results in the union of the particles of silex in the form of crystals or crystalline masses, and the entire removal of the potash by solution. If this is the correct rationale, we are obliged still to maintain that only a part of the silex is employed in forming those nodules, for a portion still remains in mixture or combination with the alumine. The silex or quartz of the granite appears in coarse grains, diffused irregularly through the beds.

Whatever rationale we may offer in explanation of this peculiar decomposition, we are furnished with a beautiful instance of a natural and spontaneous decomposition, or analysis of feldspar, as complete and perfect as can be obtained in the laboratory of the chemist; so perfect indeed, that we are able to perceive each element side by side in each of those repositories, with the exception of the potash which is removed in consequence of its solubility in water.

To assist our minds to comprehend more readily the law of those movements, which result in the formation of the concretionary masses, we may consider all the elements of the feldspar as forming at one time a plastic moveable mass like paste, and in which there is a perfect intermixture of the materials, or of the elements which composed the feldspar originally. Under those circumstances, all the truly soluble parts would be washed away or removed by infiltration through the earthy materials. Those which remain would be left to be acted upon by molecular attraction, and which would be exerted between particles of the same kind, or more especially between them. This influence would bring into closer union the particles of silex in the immediate vicinity of each other, and which, by a continuance of the same influence would produce a gradual accumulation of matter of increasing density and firmness, until finally, those movements have been imparted to the whole of the silex contained in the beds. The accumulations commence at different points, which of course constitute different centres of attraction; at each of which there forms a mass of consolidated silex or of hornstone or chalcedony. An analogous change takes place in the porcelain pulp after the materials have been ground and formed into a pasty mass in the vats in case it is suffered to stand long without agitation; for after long repose it is found that concretions of silex have already formed in the paste, indicating the commencement of a series of changes which would finally affect the entire composition of the materials, and which, if suffered to extend would spoil the whole mass for the purposes for which it is prepared.

The oxides of iron and manganese are always found associated with these beds; they occur in two forms; first, as concretions, which have been formed by the same process as the silicious; and second, as colouring materials, which are uniformly diffused through some portions of the deposite.

The oxide of manganese occurs in the original rock from which the clay is formed, in dendritic implantations, occupying the seams between the lamina of feldspar. Those dendritic implantations may have been formed by infiltration of mineral matter from above, or separated from the general mass and transferred by galvanic agency to the surfaces they now occupy. As the granite disintegrates and decomposes, the oxides undergo a partial solution, and together with the silex become in process of time uniformly diffused through the materials composing the beds. Subsequently, affinity brings the particles of manganese and iron together in the form of globular masses, so that we have all the elements of the rock, the silex, iron, and manganese, alumine and silex, each, according to their affinities, in the form of separate independent masses, or in imperfect combination. To carry our views a little farther, we may suppose that the same beds subjected to the action of heat, when another series of actions would ensue, the result of which might be the reproduction of the original rock, or of other crystalline bodies, as the silicate of alumine, iron, and manganese. We have in these changes and transformations, beautiful illustrations of the alterations in state and composition which the solid materials composing these rocky strata undergo by a modification of the force of affinity. We have too, abundance of evidence, that matter, though inert in itself, obeys the impulse of an invisible intangible power, which, though slow in its operations, yet, in the end produces many remarkable results.

Without occupying farther time in the exposition of the manner in which the porcelain clay is formed originally, or of the changes which subsequently takes place in them, I have only to remark in this connection, that the occurrence of those masses of hornstone and chalcedonic quartz, in place, furnishes us the means of solving a geological fact of some importance, as the following statement will show. Over a wide extent of country, embracing a portion of the States of New-York, Vermont and Massachusetts, there occurs small boulders of this peculiar hornstone and chalcedony. They are found loose upon the surface and in the soil, intermixed with other rocks as granitic gneiss and hornblende; but so far as I have observed, they are never found imbedded in a rock; hence their original formation, and their actual repositories were matters of doubt and uncertainty. We have, however, reason to infer that they were originally formed in beds of clay, similar to those of Johnsburgh and Athol, and that currents of water, or some other forces, have transported them from their native beds, and spread them over a wide extent of country.

Before closing my remarks on the porcelain clay of Warren county, I think it possible some of the readers of the geological reports may be interested in the general description of this valuable substance as it occurs in foreign localities, and of those varieties which are employed in the manufacture of this beautiful ware. The Kaolin, or porcelain earth, is derived from the same source, wherever it has occurred. It may always be traced to the coarse granite as its parent rock, and particularly to the disintegration and decomposition of the feldspar. All the ordinary feldspars possess the property of forming an enamel before the blowpipe, without addition, previous to the change of state which reduces them to the condition of an earth.

But subsequently to this change in consequence of parting with the potash, one of the elements of this mineral, it no longer possesses the property of forming an enamel by fusion; or in other words, it becomes infusible, and remains unchanged when exposed to the highest heat of a furnace. In this remark the petuntze of the Chinese is an exception. In this, the decomposition has not proceeded so far as to effect an entire alteration in its elements, and it still retains the property of the original feldspar, that of fusing and forming an enamel when subjected to a high temperature. The kaolins are generally meagre to the touch, friable, and unlike the ordinary clays, and do not form a paste with water. The true kaolins are formed of equal parts of silex and allumine, and that they may be employed usefully, and compose this article of luxury and of value in the arts, it is necessary they should be free from colouring matter. Generally, if not always, those clays may be distinguished from all the ordinary clays by scales of mica which indicate their origin, and also by their association in granitic districts. This constant association may often aid us in our searches for this substance, for it is constant in France, in Germany, in China and Japan.

1. *The Kaolin of Saint-Yriex.*

At this place, which is near Limoge, there is found two varieties of clay. The first is called the hard earth, and the other the soapy, or *terre dure*; the other, terre savonneuse. The kaolin is found mixed in the quarry with grains of quartz and scales of mica. The grains of the former are separated as much as possible, as they render the clay more infusible.

It occurs in those quarries at Saint-Yriex, in masses about an inch to an inch and a half in diameter. The surface of each mass is carefully scraped from all the coloured portions which may adhere to them. This part of the operation is performed by females. The hard porcelain clay, or that which is much mixed with the coloured portions, is washed after it is broken and thrown into vats, in which it is suffered to remain a short time only, when the quartz and coloured matters subside, the water is drawn off into other vats, in which it is suffered to repose, when the fine particles are precipitated to the bottom. This portion, after it is consolidated somewhat and dried, together with the pure masses which have been selected at the quarries and put in order by females, is sold at Saint-Yriex at 7 francs and 50 centimes per cwt.

The petuntze, which is the feldspar but slightly changed, and still retaining its potash, is not so valuable. This is used principally for the glazing, or for forming the enamel. The porcelain quarries of Saint-Yriex were discovered in 1760. They furnish at the present time most of the materials for the manufacture of this ware for all France, though there are many localities of this substance in this country. It is well known that the French porcelain is far superior to the English, and in fact to any other; and it has attained such a degree of perfection, that it is considered the *ne plus ultra* of the art.

2. *Kaolin of Siberia.*

Similar to those of France, are the quarries of porcelain earth of Misjœk, Jelowoi and Jelandishik, in the province of Isetsk, in Siberia. The establishment for washing and drying it, was founded in 1750. The first operation is performed on a grand scale. A number of tons of the rough kaolin is mixed at once with pure water in vats, which after remaining a suitable time, is drawn off into tubs, from which again it is made to pass through seives of horse hair, and again it is filtered through those of taffeta or silk. Having passed through these several washings and filtrations, it is then put into the store house, where the whole liquor is suffered to repose and become partially clear; it is then drawn from the large vats by orifices situated at different heights from the bottom. When the earth has attained, in the last vessels into which it is drawn, the thickness of pap, it is again decanted for a third time into tubs disposed according to the state or condition it is in. The kaolin thus purified, is transferred to rooms strongly heated by stoves, disposed on lattice work, and covered or defended by lace from dust, &c. It is afterwards moulded into regular shaped masses of about 40 pounds each. The earth thus prepared, is transported to St. Petersburgh, for the use of the imperial establishment. The quarries of Misjœk contain large plates of mica similar to those of Saint-Yriex, in France.

3. *Kaolin of China.*

The vast empire of China furnishes a very great abundance of this valuable earth. There are numerous manufactories of it at Nankin and Tinqui. The period of their establishment is unknown, as well as the mode pursued in the manufacture of it. The borough of Kin-te-tchin, in the province of Kian-si, is the place where the best China ware is made. It appears that as early as the thirteenth century, what is usually called the China ware, was then manufactured at the city of Tinqui.

It is customary in China, to leave the earth exposed to the air for thirty or forty years; it is accumulated and preserved by the father as an inheritance for his children.

In those accumulations, the petuntze undergoes a further decomposition, and finally passes into the same state as the French porcelain earths.

In general, the kaolin forms the base of the China ware, to which is added sulphate of barytes.

The enamel is made of petuntze and feldspar. Besides this, it is said that the pieces are sprinkled with a species of fine earth previous to their painting, which produces a wonderful effect in increasing and augmenting the beauty of the surface, and which lessen also very much the labor of painting.

4. *Kaolin of Vicence.*

There is a beautiful earth at Schio, in the Vicentin, which is known in commerce under the name of *terre de Vicence.* It is a kaolin proceeding from the decomposition of pyritous felspathic rock. This earth was once an object of an active and flourishing commerce; it was formerly even exported to England, but since the government of Venice has given the exclusive privilege to the national manufacture, its exportation has ceased, or has very much diminished.

5. *Kaolin of Saxony and Prussia.*

The manufactory of porcelain at Meissen, in Saxony, is justly celebrated. The earth is found in the vicinity of Scheeberg. The quarries are explored by wells and galleries; they yield only about 400 quintals of earth annually; it possesses the same character as the French, and the mode of manufacture is much the same.

6. *Kaolin of England.*

The kaolin of England is associated with the ores of tin. It is found particularly in Cornwall. This association ought not to be forgotten in this country, as it is well established that the ores of this valuable metal belong only to granitic rocks. The earth in Cornwall presents no characters to distinguish it from the same earth in other countries. It is, therefore, unnecessary to extend my remarks upon it, as they would only form repetitions of what has been already stated.

Besides the kaolin which results from the decomposition of granite, another material has been substituted in the manufacture of porcelain. It is a carbonate of magnesia mixed with a small per centage of silex. It is a white compact earth, and often resembles the white calcareous clays. It softens in water, but does not form a paste with it, except after a long pounding and maceration. It effervesces with acids, and is covered with saline efflorescences, after being moistened with dilute sulphuric acid; when exposed to the blowpipe, it hardens, but does not fuse, except on the sharp corners of the fragments the most exposed to heat. This substance, besides being employed in the porcelain manufacture, is made into pipes, for which it is well adapted.

To return to the clays of Warren county. I would suggest the possibility of employing those which are coloured, (and which, on this account, are unfit for porcelain,) in the manufacture of pipes and the coarser kinds of pottery, where colour is not a matter of much consequence. They would form excellent crucibles and pots, and if mixed with the proper proportion of feldspar, an excellent glazing or enamel for the ordinary earthen wares. The clays of New-York are mostly calcareous, and hence fusible and ill adapted for any kind of ware which requires a high temperature in baking or burning. These clays, then, are of great importance, and may justly be considered as a great accession to the mineral riches of the State.

Marble.

Marble of different kinds and qualities is abundant in the Second Geological District. Some of the varieties have been noticed in the preceding reports. Many of the localities are favorably located, both as to water power for sawing, and for safe transport to market. The only variety of marble now wrought belongs to the Trenton limestone, or blue limestone as it is called. This is usually dark, varying from a dark gray to a jet black. The dark colours have generally obtained the preference in market for mantel pieces and ornamental work.

One of the most valuable quarries which has been opened is at Glen's Falls. Nature at this place has exposed the strata in such a way that the whole thickness of the limestone can be examined without the labor of artificial or expensive mining. The river has cut into the rock to the depth of at least 70 feet.

The marble is extensively manufactured by two enterprising companies; it is therefore favorably known to the public, and has acquired a high reputation. For this reason it would be superfluous for me to give a particular account of its qualities. I take the liberty, however, to subjoin a letter which I have recently received from the agent of the Glen's-Falls company in relation to the position of the marble in the quarry, and also of the quantity which has been manufactued, &c.

" The Hudson river at Glen's-Falls has worn a passage through the limerock to a vast depth, rising in some places seventy feet from its surface. The strata measure from one inch to ten feet. A short distance from the river, on the Saratoga side, lying on limestone, is found black slate. Succeeding this are found strata of marble; slabs have been sawed and used for fire-places. It is sound, and of good colour. Succeeding this on both sides of the river, are found 50 strata of limestone, composed in part of organic remains. Next in succession are found strata of gray marble, two and a half feet thick; it receives a fine polish, but the colour is not admired. A stratum of darker colour follows this which is six inches thick, though valuable only for stepstones. Then follows the black marble, which for brilliancy of polish and beauty of colour, perhaps, has no rival. The whole stratum is ten and a half feet thick. Veins of organic remains run at irregular distances from each other through the strata; these veins are from two to four inches thick, running ten and sometimes twenty feet, break off abruptly. Where these veins do occur, though they are not numerous, they rather mar the beauty of the marble. Who first discovered this marble is not known, and it is of little consequence to inquire. Numerous attempts were made to work it, but without profit, until the present company received it.

" The following exhibits the amount of stone which the Glen's-Falls Company have prepared and sent to market during the last four years. The company run 16 gang of saws, which are equal to about one hundred and sixty single saws.

In 1835,...............	2,157	feet, or	32,000	pounds.
1836,...............	19,800	"	278,500	"
1837,...............	23,400	"	333,900	"
1838,...............	25,000	"	352,500	"

" It is remarked farther by Mr. Roberts, the agent of this company, that the Glen's-Falls marble has gained a good reputation with most of the workers of marble in New-York, Boston and Philadelphia, as it regards its colour, the polish which it receives, and the ease with which it works; and that it is considered equal to any of the kind in this country.

" He states that they have got out shelves for mantels seven feet and six inches long, thirteen inches wide and one and a quarter thick, which sells for sixty-five cents per foot. The price for this kind of stuff has fallen, and at the present is worth from fifty to fifty-five cents per foot; that which is shorter, from thirty to forty."

There are some considerations in relation to the marble business, which are necessary to be understood by those who are disposed to engage in it.

1. The expense of opening the quarry.

2. The soundness of the layers which it is proposed to work.

3. Their freedom from hard or flinty particles or masses, as quartz, hornstone, &c.

4. Sufficient thickness in the several layers composing the bed; for unless there are a number of layers of sufficient thickness to work in juxtaposition, it will be necessary to remove a great mass of useless material. Small defects, such as checks, seams or cracks, or imbedded masses of flint, reduce the value of any piece materially. It is necessary therefore that there should be a general freedom from all the above defects, in order to make it a profitable business.

A variety of marble quite distinct from the preceding, occurs among the primary rocks, principally in the gneiss districts. It is that variety which is known among the mineralogists of this country as the *verd antique.* It is therefore formed by the intermixture of the primitive granular limestone and green serpentine. The limestone varies from white to grayish white, and the serpentine from dark grass green to straw yellow; hence there are many varieties of this kind of marble, even in the same quarry.

The variety of shade depends mostly on the serpentine. This occurs in it in small and larger masses, perfectly distinct, and free from the limestone constituting its ground or base, but at its borders it blends with it, and forms thereby a clouded appearance as the two mingle and combine with each other; there is therefore no sudden transition of colour which is seen in the variety of Italian marble, known in market under the name of Egyptian; the tints and colouring are gradually softened into each other. In polishing, the colours and shades are often brought out in ideal landscapes, which have a very pleasing effect.

The verd antique has been discovered since the commencement of the survey; it was entirely unknown in this State previous to my discoveries of it the last season, and which was made known in the second report. Since I have found it extremely abundant, and of an excellent quality. The question concerning its value can only be settled by trial; it is of no value, of course, unless it can find a market, and this depends on the taste of community. Were it not for the fact that we often admire a thing because it is foreign, and has been imported at a great expense, there could be no doubt on this point; but as it is, many years may elapse before its reputation can be established.

It is not improbable but that our verd antique may find a market abroad, and it would be well for those who are personally interested in the subject to prepare samples of it and send them to England. This variety is known to be scarce in Europe, and it might be introduced for tables and other ornamental purposes at once, if there should be a judicious selection of the varieties.

In polishing it, it is necessary to observe more care in giving the final finish. The serpentine being softer than the limestone, wears away more rapidly, and if regard is not given to this part, the former wears below the surface of the latter, and may not therefore be brought into so direct a contact with the polishing agents; it may be left with less lustre, though it is as susceptible of receiving a high polish as the limestone.

This variety of marble occurs abundantly in Moriah, Warrensburgh, Athol and Johnsburgh. It is an unstratified rock, but breaks readily into oblong masses of a shape suitable for working in the ordinary mills for sawing stone. Its occurrence is similar to the primitive limestones which were described in my last year's report.

In selecting quarries of this material, it will be necessary to reject those which contain masses of the silicious minerals, as quartz, augite, scapolite and hornblende. Experience will, it is believed, establish the opinion I entertain, and which I have often expressed, that those masses do not extend into the interior of the rock, but are confined mostly to its surface.

This rock is always more or less weathered upon the surface; hence it presents a rough, ragged aspect, which arises from the disintegration of the limestone, leaving the serpentine in relief. This effect is produced by long exposure, and is no objection at all to the rock, as might at the first view indicate. All rocks are weathered more or less, even the hardest, or those composed of silex. The limestone, when pure, in weathering undergoes the change uniformly, and therefore leaves an even surface; whereas the verd antique is composed of two materials, one of which is acted upon more than the other; hence the latter is left in irregular shaped masses on the surface. This fact entirely conceals the character of the rock, and an ordinary observer would not suspect to find in it a marble, or a rock which could receive a polish. Another fact of importance in regard to this stone, is that it is very strong and sound, and appears, though no experiments have been made in regard to it, equally strong in every direction. Its soundness appears at once when struck with a hammer, in ringing sharply like good earthern ware.

It also appears when we attempt to break it, exhibiting a toughness which approaches to that of hornblende.

This property is evidently one of importance; it is more useful for mantel pieces, or in any work where pressure is concerned, less danger in transporting to market, and less risk both to the seller and buyer. It will be found more durable than many of the white marbles, as it is never arenaceous or pulverulent.

Peat.

From the abundance of peat in this State, it appears that the climate and other circumstances are favorable to its production. It is not so hot as to cause a rapid decomposition of vegetable matter, nor so cold as to prevent those changes, somewhat allied to fermentation, which are required for its formation.

Mr. Mather, in his report for last year, gave extensive details of the quantity and value of this substance in the southern counties. It appears from the above report, that the quantity is quite sufficient for its demands at present: when we take, however, into consideration its great value to the agricultural, manufacturing and commercial interests, and the probability that the demands for it will greatly increase as its worth becomes more extensively known, there is no reason to fear that the supplies will be greater than the demand.

I remarked in my report for last year, that little or no peat had been discovered in the counties of St. Lawrence and Essex. I feared, therefore, that this valuable substance would not be added to the list of the useful productions of the northern section of the State. Contrary to expectations, I have discovered it in many localities, and find it in great abundance in the counties of Clinton, Warren and Hamilton; and I may state in general, that most of the fly's in those counties abound in this substance.

It will not be necessary nor useful to give a particular account of all the localities of peat which have fallen under my observation during the past season. The only places where it can occur are those of a marshy character, and the substance itself may be tested by any person, by first drying and then igniting it; if it burns, it is peat. As its presence may be suspected in all low, wet places, especially those bordering on ponds and lakes, it will be well to search for it in all such places, by thrusting down a pole or stick and trying the matter that adheres to it, as it regards its combustibility; or it may generally be found wherever the surface of the ground is easily agitated by passing over it. One of the largest collections of this substance which has fallen under my observation is in Champlain in the county of Clinton. The peat marsh, or fly, to which I refer, is in the west part of the town, and is about two or two and a half miles in length, and from a half to three-fourths of a mile wide. Over the whole extent of this fly a pole may be thrust down from 12 to 30 feet, and probably in many places to twice 30 feet. It is of course nearly inexhaustible. Others, of nearly equal extent, occur in the county, and many which are less extensive. One fact, which applies to all the peat marshes of this neighborhood is, that they are situated far above the present level of the lake, and that those marshes which are on, or near the same level as the lake, do not contain peat, and those are quite numerous. This statement, if it should be found true, without exception, seems to indicate that the lower marshes have not been reclaimed from the deep long enough for this substance to form, and it goes to support the opinion I have elsewhere advanced, that this region has been subject to repeated osscillations since the commencement of the present order of things.

Another important growth of peat is found in Warrensburgh, Warren county, on the farm of Mr. Richards. In extent it occupies about 60 acres. It is upwards of 60 feet deep, as has been proved by sounding; hence the fly is not so extensive in superficial area as many others. It still contains a vast amount of peat. It is of an excellent quality and easy of access. The value of a marsh of peat may be estimated by determining the worth of a cubic yard, or a load, or any given quantity, and calculating the amount of peat which is contained in the area. The quantity of peat in a square rod of surface, and worked to the depth of 30 feet, would furnish 284 loads, which may be considered as worth 50 cents per load, or if we estimate it at only half this amount we perceive that 50 or 60 acres of it is almost invaluable when favorably situated. Even a small bog in the centre of a farm might be employed to increase its value one-half, as it would furnish an abundance of manure for an indefinite period. Many smaller deposits of this substance I found in the towns of Schroon, Chester, Warrensburgh, Johnsburgh, Queensbury, Lake-Pleasant and Wells, varying in extent from one to five acres.

There are four purposes to which peat may be applied:

1st. As a manure. To secure or obtain an important result something more is necessary than simply to spread it upon the soil. It should be raised in the fall, spread in the barn yard, or placed in heaps and mixed with animal matter and lime. Placed under these circumstances it is exposed to the frost and the atmospheric agents, which produce in it incipient chemical changes necessary to convert it into the nutriment of plants. This is especially the case when lime is added to it, which forms a soluble salt, the *geate of lime*, with a portion of the vegetable matter. In the spring it is prepared for removal to the field, and may be spread upon the meadow for grass, or it may be used as a manure for corn, potatoes, &c. It will not answer a good purpose when employed without due preparation, especially when it is spread on meadows for grass; it then becomes dry, is insoluble, and of course unfitted for the nourishment of vegetables. The same remarks might be applied to the preparation of peat as are recommended under the head of preparation of the marly clays.

2d. Peat, as is well known, answers a good purpose for fuel, and undoubtedly ranks next to coal for sustaining for a long time a high temperature. There is no substance which would remove so much suffering among the poor as the general introduction of this substance for fuel in our larger towns and cities. Its abundance and cheapness recommend it to the attention of the public, and if measures could be devised to bring it into use in this State, many important results would follow.

3d. Peat furnishes an abundance of carburetted hydrogen, and hence may be employed for producing gas light. Dr. Lewis Feuchtwanger, of New-York, has made known to the American public the experiments of Merle, a director of a gas light company in France. The advantages of peat for the production of gas are as follows: 1st. It is less expensive than gas from coal, oil or resin. 2d. The produce is nearly as much as from those substances. 3d. The gas is quite harmless and inoffensive, and has, in respect to healthfulness, great advantages over some of the other kinds of gas.

4th. After it has been employed for gas it may be used for fuel, and it is equal to any charcoal.

According to Merle, one thousand kilogrammes of peat, when distilled like coal for two hours, yeilds eight thousand cubic feet of gas, which has rather a weak illuminating power, and contains much carbon, and which, though purified by water, loses a great deal more of its strength; but if the same is distilled for three-fourths of an hour, only five thousand five hundred cubic feet of a pure gas are obtained, but which affords a stronger and whiter light than coal or oil gas.

An apparatus, consisting of a condenser with eighteen tubes, is fixed for purifying the gas, each tube stands in a reservoir of flowing water, so that the gas has to pass eighteen times through the water; during its transmission it is not deprived of its carbon; in addition to this, it has to pass through two layers of dry lime; the gas thus purified retains no offensive odour, and may be respired when mixed with atmospheric air without inconvenience.

I have copied the whole paragraph from the Journal of Science, with some slight alterations, in order to bring a subject so important once more before the public.

If the above details may be relied upon, and if the experiments of Merle are satisfactory, if peat can be employed to advantage in the production of gas, it becomes one of the most important natural productions in the State, second only to coal for fuel, and equal to it for producing a beautiful and agreeable light. It would at once become a source of individual wealth, and furnish employment for a multitude of laborers, and increase the amount of transportation from the interior of the State to the cities and larger villages. It would employ a vast amount of material lying useless and unproductive, and one, too, embraced in our own territory. It would be using a great capital which has been accumulating for a long time, and has been reserved in store for this age of enterprise.

Perhaps it would be saying too much to assert that peat is more valuable than coal, but when we consider that for creating heat it is not very inferior to bituminous coal, that it contains a gaseous matter equal in illuminating power to oil or coal gas, that its production is equally cheap, and in addition to this that it is a valuable manure if properly prepared, its real and intrinsic worth cannot fall far short of the poorer kinds of coal. There is one consideration which commends itself to the philanthropic of all our large cities, viz. the introduction of peat as a fuel to supply the necessities of the poor. It is believed that much suffering may be prevented, and much comfort promoted, by the use of peat in all places where fuel is expensive, as in New-York and Albany. A careful examination, therefore, of places favorable to the production of this substance, is a matter of some considerable importance, as it is the next best substitute for the more expensive article, coal, and any thing for fuel which will save a farther destruction of the forests, both in New-York and the New-England States, is worthy of adoption from more considerations than one. A due proportion of wood-land to that under tillage, adds greatly to the beauty of any district of country; but above all, the preservation of timber lands is becoming a matter of great moment, and calls for legislative aid and encouragement.

Again, since the above was written, I have been informed by an intelligent gentleman, that peat, as a fuel for steam engines, has been proved by actual experiment of great value. To impart to it the power of emitting during combustion a lively flame, a small quantity of tar is mixed with it, which of course creates a larger volume of flame, which is a matter of considerable moment when employed in generating steam. The experiments referred to were made on board of the Great Western during her last passage, and such was the result that a large amount of peat was taken on board for her homeward passage. The introduction of pressing machines, both for the expulsion of water and diminishing the bulk by compression, will be important to all who engage in raising peat.

I see no reason for extending my remarks on the value of this substance. I shall, therefore, state only one more application of this material, viz. as a substitute for charcoal in the reduction of iron. The coal which is formed from it is equal to any coal; hence, it may become of great importance in those sections of country where fuel is scarce, or as it furnishes a resource in this important business, when the ordinary means are expended. We have, therefore, in this homely substance an invaluable article, of which prejudice alone can prevent a general use.

Black Lead. Graphite.

There are several places where this useful substance is found. The most important are situated in Ticonderoga, Crown-Point, East Moriah and Johnsburgh. The graphite of Ticonderaga is well known in market, and has been explored to a greater extent than any other locality in the State. The proprietor of the mine has usually raised it in the autumn in sufficient quantities to meet the demands for it during the next season. The working of the mine is in the rudest manner. As the mineral is in a vein varying in width from 2 or 3 inches to 12 or 15, it was necessary after the surface portion was removed to break away the adjacent rock. This has hitherto been accomplished by heating the sides of the vein and then suddenly cooling them; in this way exfoliation and cracks are produced, and an opportunity furnished to a limited extent of removing portions of the rock adjacent to the graphite.

In this manner the vein has been explored 10 or 15 rods in length, to the depth of twelve feet, in some places. By this mode of procedure the opening downwards has become wedge form, so that it is now difficult to pursue it much farther in that direction. The best part of the lead of this mine is manufactured into pencil points on the spot.

The graphite of Cedar-Point, in East Moriah, has not been explored very extensively, its character was destroyed soon after the mine was opened, in consequence of mixing the oxide of iron with it, to facilitate its passage through the mill in grinding, a mixture which entirely destroys its value for any purpose to which it is ever employed, even for the blacking of stoves.

The locality in Johnsburgh is on the farm of Mr. Noble. The mine is only partially opened, and less than a ton has been raised. It is, however, of a good quality; it occurs in irregular shaped masses of various sizes, and weighing from one to twenty-five pounds. It is associated in a vein of quartz. It occurs in stellate masses similar to that at Ticonderoga. In the vicinity I found perfect hexahedral tables of graphite, which exhibit lines on their broader planes crossing each other at oblique angles, indicating by their direction the system of crystallization to which they belong.

This mineral has occurred in independent masses in the rock and even in the soil. A locality of this kind was discovered in Athol, which contained several tons, the whole of which has been sent to market. Those deposits appear disconnected with a regular vein, and hence they ought always to be carefully examined by persons intending to purchase them for the profit of mining.

Preparation of the Marly and Tertiary Clays.

In agriculture, as in all other kinds of business, many things fall into discredit in consequence of misunderstanding the principle on which their use depends. For instance, the use of plaster on most soils is decidedly beneficial, but there is such a thing as an excessive use of it, and of persevering in its use too long, when its specific effects are imperceptible, and it becomes of no value whatever.

The due preparation of soil is always an essential matter for the production of a good crop, or to produce a favorable result either in an experimental trial of any new variety of grain, or new mode of culture of those ordinarily raised. It is a matter of common observation, that one farmer succeeds well in his crops, while another does not, though his natural circumstances are equally favorable. Remarks of a similar nature may be made in relation to manures. One succeeds admirably in the use of marl, while another after a little trial, wholly discards it as useless, if not hurtful. This difference of opinion and practice, which is often the result of experiment, is owing to several obvious causes, such as the different modes adopted for securing the end proposed, and which arises from an imperfect or vague notion of the principles by which the desired result is to be produced.

In the use of the clays, as the common, marly and tertiary, I have found a variety of opinions, each of which, it is pretended, are based on experience. One considers them hurtful, another as useless, while a third finds them, on trial, very useful. It is important to understand how such a diversity of opinions exists, when they are founded on experience.

I conceive that there are two reasons for this. In the first place, the original character of the soil is such that the use of the clays, under no circumstances, would be proper, or followed with beneficial results. Clay already forms an abundant element in the soil, both for the aliment of the plant, and for the firmness of the soil. In the second place, it is not used in the right state or with due preparation. This leads me to the direct question, What is the right mode of using the clays, or what preparation do they require?

1st. The great point to be attended to, is to secure a sufficient degree of fineness, that they may be incorporated with the soil, and form, strictly speaking, a constituent part of it. To attain this object, it is necessary that they should be raised in the autumn and placed in heaps, that they may be exposed to frost and the atmosphere through the winter. To assist still further in the process of pulverization, it is better to mix them with barn-yard materials, straw, manure, and refuse of any kind, either animal or vegetable. This course being pursued with them, they should be spread as evenly as possible on green sward, that they may enjoy the further benefits of air, moisture, &c. by direct exposure during the season. Besides, the grass in passing up through the layer will assist greatly in producing a comminuted state. The succeeding season, it is in a state to be ploughed in, when it is duly prepared to become a constituent part of the soil; it is only in this way that the stiff and adhesive clays can be broken up and prepared for an incorporation with the other earths.

Suppose a different course was pursued. Instead of raising the clays in the fall, it was raised and spread immediately in the spring, and ploughed into the soil; the result would be, that it would remain in masses in the earth, and unmixed, in which state it will continue for years with but little change, and instead of being a benefit, it would rather form an annoyance, and incommode both the farmer and his crops. From these remarks, it is clear how two farmers might disagree in their experience with the clays. One, by a suitable preparation of the material, finds a great advantage in their employment; another, by throwing them on or into his soil in lumps, perceives no effect on his crops, or is incommoded by the hard baked masses of clay which a hoe can scarcely divide asunder. It is true, that in time, those masses would disappear, and finally they would become incorporated with the soil, but several seasons would elapse before this would take place, and the result of the trial would be such as to discourage the further employment of the article; besides, I believe that clay or any other material is more readily broken down and pulverized when first taken from the bed than afterwards, when it has been exposed to the hardening influence of the sun during the warm season.

The necessity of an intimate mixture of any substance intended to act as a manure, cannot be too much inculcated by the agriculturist.

Most of the clays of this State are those which are marly, or which are combinations of clay and carbonate of lime. They are widely diffused, but their value is not highly appreciated. The time is not distant, however, when they will be esteemed as highly as plaster. They have even one advantage over plaster, that their effects are more lasting when they have had a due preparation.

The practice of employing vegetable or animal substances in conjunction with marl, or the varieties of calcareous manure, has not prevailed to a suitable extent. It must be plain that carbonate of lime, or sulphate of lime, cannot support vegetation without other materials. It appears, however, that a large proportion of the food of plants exists in the earth in an insoluble state; and that it is by a chemical union of the calcareous matter and this insoluble vegetable substance that it becomes soluble, and fitted for the sustenance of plants in general; hence arises the mutual benefit of combining earths with vegetable and animal substances; and hence, too, the bad practice of continuing the mineral manures until the whole of the vegetable and animal matter is withdrawn from the soil; for by the increased activity of the growing vegetable, the soil is rapidly exhausted of its nutricious matter, and it is left comparatively barren, if the agriculturist ceases to apply vegetable and animal matter. There remains then but one course, that of supplying directly the necessary nutriment; but it is unquestionably better to maintain a sufficiency of vegetable matter always in the earth, and never suffer a soil to be exhausted or worn out by overtaxing its resources.

HAMILTON COUNTY.

Without entering into details in relation to the geology of Hamilton county, I shall confine my remarks to subjects of a general nature, reserving the more minute relation of its local formations to the future.

This county is underlaid by primitive rocks, with the exception of a narrow strip of the Trenton limestone extending along the Sacanadaga, in the town of Wells. This strip is less than one-fourth of a mile wide, but may be traced with some interruptions for two or three miles. It is a thin stratum, and much broken by partial uplifts. It is filled with organic remains common to the Trenton limestone. It is quite an important rock to the inhabitants, furnishing a cheap and convenient material for lime, and sufficient in quantity for supplying the demands for building, and for agricultural purposes.

The primitive rocks are gneiss, hornblende, primitive limestone and serpentine. These are arranged as in other portions of the district. Gneiss and hornblende are the predominant rocks, while the limestone and serpentine occur in irregular beds, or veins, apparently subordinate to the former. I am led to remark in general, that we find no new arrangements of mineral matter, or new phenomena as regards position; but a continuance or extension of the same as they occur in other portions of the district, thus showing an uniformity in the operation of the laws of nature.

Hamilton county is as yet a wilderness, and consequently we labor under great disadvantages in attempting to explore its mineral riches; should it equal, or even exceed, the other counties of the district in this respect, a full development of them cannot be expected at present.

Contrary to the published accounts, and to common opinions, which are of course formed principally from those accounts, especially from Burr's and Gordon's statistics of this county, I have the pleasure of stating that it is far from being that *wet*, *cold*, *swampy* and *barren* district which it has been represented to be. The soil is generally strong and productive; the mountains are not so elevated and steep but that the soil is preserved of sufficient thickness to their tops to secure their cultivation, and most of the marshy lands may be reclaimed by ditching; by this means they will become more valuable than the uplands for producing hay. In fine, it will be found an excellent country for grazing, raising stock, and for producing butter and cheese. The strength of the soil is sufficiently tested by the heavy growth of timber, which is principally of hardwood, as beech, maple, yellow birch, butternut and elm. The evergreens, or pines, are confined mostly to the lower ranges of mountains. Some of them are of the largest growth of any in the State, and are suitable for the main shafts of the largest of the cotton mills. In the main the county resembles the mountainous districts of New-England, and like those, produces the same intermixture of forest trees, and has about the same adaptations for the production of the different kinds of grain, as wheat, rye, oats, peas and barley, together with fine crops of potatoes.

The face of the country varies from hilly to mountainous. A low range of mountains cross the county between the town of Wells and Lake Pleasant; the whole width is not far from six miles. This range, in its progress northeastwardly, increases in elevation until it constitutes the highest of the mountain groups in the State, in the towns of Moriah and Keene.

From six to ten miles westwardly from Lake Pleasant, another low range of hills and mountains cross the county parallel to the former, but do not attain an equal elevation. The highest summit of this range is in township No. 19. From these remarks, and from an inspection of the maps, it will be perceived that Hamilton county is situated west and southwest of the mountainous track in which the most elevated groups occur. Its location in general is more favorable than Essex county, in which those ranges attain their highest elevation.

From the observation of persons who have been residents of the county for a number of years, it appears that the seasons are much the same as it regards heat and cold, the length of the summer, &c. as the mountainous parts of New-England. The incorrect opinions which prevail as it regards its soil and its irreclaimable marshes have arisen undoubtedly from hasty examinations. It is true, that the flys or marshes are numerous, but they are not so wet as to be unproductive, or so sunken as to form nuisances. Where the timber is removed, they produce spontaneously a heavy crop of grass, which is reproduced from year to year without cultivation. Again, the flys are bottomed on a hard clean gra vel and sand which occurs at the depth of from 1 foot to 10; but when the depth is greater, it is not an unfavorable circumstance, for in almost every instance of the kind, I found the superior stratum to consist of peat.

So far then as it regards marshes, wet and cold lands, and irreclaimable bogs, they are rare, and most of the marsh land forms the most valuable and productive portions of the county; producing, as I have already remarked, a valuable grass, called the *blue joint*, and which makes a nourishing food for cattle without the labor of tillage, or supplies it until such times as the better grasses can be raised by the ordinary labors and prosperity of the husbandman.

Again, it is probable that when the county is settled extensively, and the timber and wood removed, there will be an amelioration of climate; it will then become drier and less frosty, and the summer warmer and better suited to the raising of corn. The condensation of moisture over an extent of surface equal to this uncultivated tract in this section, must have a great influence in reducing the temperature to a low standard. The density of the forests, the thick growth of underwood, effectually excludes the rays of the sun during the entire summer. For this cause the temperature of a wooded district is considerably lower than an open country under tillage.

The most interesting physical features in this county arise from the number and beauty of the lakes which are sprinkled liberally and picturesquely over its surface.

Much has been said of the clearness of the waters of Lake George, and not without reason; if however, the traveller will extend his wanderings to Lake Pleasant, Round, Piseko, and Racket lakes, he will find them its equals, if not its rivals. The clearness of the waters in all these lakes is owing to the primitive character of the region in which they occur. The lakes of Hamilton form a beautiful addition to the scenery of our country. Although the mountains are not so high as those of Scotland, still, it will be a matter which will occasion no surprise, (when Americans shall have acquired sufficient independence to admire a thing that is American,) if these lakes do not become objects of admiration, and shall be considered as vieing with those of Scotland. Settlements are now forming on the margin of those beautiful sheets of water, and were buildings erected suitable for the accommodation of travellers in some central place among these lakes, (which we doubt not will be the case in a short time,) our pleasure seeking community, of whatever cast, could spend a few days or weeks, with as much zest as is afforded by any of the places of public resort which are so thronged during the heat of the summer. As I have already intimated, the axe has been laid at the root of the tree, and ere long where naught now greets the eye, but a dense, and to appearance impassable forest, will be seen the golden grain, waving with the gentle breeze, the sleek cattle browsing on the rich pastures, and the farmer with well stored granaries enjoying the domestic hearth.

A subject which involves more deeply the interests of this section of country, may with propriety, be introduced in this place, viz: the means of forming easy communications with different portions of this and the neighboring counties. To enter fully into this subject, would require a collection of facts foreign to the objects of the survey; but the few I am in possession of may lead to a more careful examination of the subject, and finally result in something highly beneficial to this section of the State. From actual observation it is proved that the lakes above mentioned, vary but little in their relative levels, and that those which are connected by streams flowing from one into the other have but little fall, and in fact the larger are not rapid, and are at present navigable for small boats. Such being the case the large sheets of water may be connected with little labor and at a trifling expense. The distance between Piseko and Round lake is six or seven miles, and in this distance the fall is not more than 20 or 25 feet. Round lake is already connected with Lake Pleasant by a natural canal; the water is discharged from Lake Pleasant in a still stream, which is now boatable three or four miles; thus by the connection of these waters the expense of which could not be great, there would be a water communication for twenty-three or twenty-four miles. Again, there is a fall of about 15 feet between Round lake and Jessup's river, which is a stream of sufficient magnitude to sustain boats of several tons burthen. This river runs north twenty-five miles; has no falls, and is not a rapid stream; flowing north about ten miles it approaches Lewis' lake, the outlet of which is a sluggish stream, which in the distance of three or four miles falls into this river. The distance between Lewis and Indian lakes is twelve miles, and the whole distance is boatable. These waters therefore, which flow north, may be connected with Round lake at a comparative trifling expense, and thus open a boat navigation in that direction twenty or twenty-five miles. The Indian river, which is an outlet of Indian lake, and receives also the waters of Jessup river and Lewis lake, soon turns its course eastwardly, and empties into the north branch of the north river. Leaving therefore the Indian lake and river, and proceeding in a northwest direction, we soon reach the head waters of Racket lake. It is said that in passing over a very slight elevation or ridge, we come upon a small lake, and following its outlet we may pursue an almost uninterrupted course into Racket lake, and thence into Long lake. It is over this carrying place, between Indian lake and the first lake in the series towards Racket lake, that the Indians are in the habit of travelling, and over which they carry their canoes. The whole carrying distance from Indian to Long lake is six and three-fourths of a mile. The whole course of the route which I have now traced, is one which is feasible for the construction of a canal, and one too which would require but little capital, as there are no high summits to cross, nor heavy falls to encounter, or which would demand a great amount of lockage. But the internal navigation need not end here, for the waters of Racket lake may be connected with those of Moose river, for with scarcely a carrying place, the hunters and fishermen take their boats from the Racket lake into the head waters of Black river. And again, I was informed by a gentleman of Lake Pleasant, that during a visit to Racket lake, a few months previous, he met with two fishermen who came seventy miles in their boats and brought several barrels of salt; and they came the whole distance in their boats from the waters of the Saranac, for the purpose of fishing in Racket lake, from which they carried away seven barrels of lake trout on their return over the same route.

The practicability of uniting the head waters of those streams which flow into the Hudson, Lake Champlain and St. Lawrence, is not doubted by those who have carefully observed the features of the country.

It may be inquired what advantages would result, which could justify an expenditure of capital in a region considered of little value for agricultural purposes.

1st. I will say, that it is not, as has been already intimated, that bleak, barren, desolate tract, which it has been represented to be; but is well adapted to the cultivation of wheat, and suitable for all agricultural purposes, though it is more especially adapted to grazing, and the making of butter and cheese.

2d. This region abounds in the ores of iron, limestone, marble and the usual products of a primitive region.

3d. It would be the means of bringing into market (of which there begins already to be a scarcity,) a vast amount of lumber, which, without facilities of the kind, must be destroyed or wasted on the ground, without benefitting the public extensively.

4th. Inasmuch as communications of some kind must be formed in inhabited districts, the expense of a water conveyance through this region will not be much greater, *in the end*, than an ordinary turnpike; a canal, therefore, might be used as the great thoroughfare, while the minor points would be connected, as usual, by roads.

The above suggestions will appear more important and in their true light, when taken in connection with the proposed rail-ways from the St. Lawrence to Champlain. In case the southern route should be selected, the whole interior of Hamilton and the adjacent counties, to some extent, would be furnished with an easy and direct outlet to market. It is difficult to make an estimate of the number of miles which would be opened at once for batteaux navigation, and which might be opened at a small expense, but it is not extravagant to estimate the distance as equal in length to the Erie canal. There would be opened, also, at least fifty miles of direct steam-boat navigation, by constructing a single lock between Crotched lake and Long lake, and another between the former and Racket lake. The latter is one of great importance, and is much larger than is represented on the maps. It is deeper and more extensive than Long lake. It has several bays which project from the main lake five or six miles; it is probable, therefore, that the amount of water in Racket is double that in Long lake. I have already remarked that the character of the borders of the lakes and streams is well adapted to the easy construction of paths and roads, in consequence of the predominance of hard gravelly bottoms. There is another consideration not to be overlooked, that the whole country being situated upon table land, is not exposed generally to injury by freshets; hence, public works, as embankments, &c. constructed along the rivers and borders of the lakes, will not be liable to excavations by the rapid rise of water; hence, too, the expense for repairs will not constitute a heavy drawback on the profits of the works contemplated. I am sustained in this position by the preservation of the great State road passing through this country, which, though constructed a long time since, has suffered very little in its foundation.

In conclusion, I remark, that whatever may be the present interests of individuals, or the present policy of the State, this region of country cannot remain long unoccupied or unimproved. It would be well, however, if this policy could be settled soon, for landholders would then feel the importance of employing agents to maintain an oversight of their lands. At present, they are exposed to the wanton destruction of trespassers, who for a single cut of a pine, make no more scruple in felling the venerable individual of two centuries, than in cutting the sapling of yesterday.

CLINTON COUNTY.

I shall not attempt to give in detail the geology of Clinton county in the present report, or present any thing like a full account of its natural resources. A large and interesting portion of it has not yet received that attention which it deserves or is entitled to, and the remainder has not been examined at all. So imperfect are my own views, and unfinished my labors, that I prefer a delay of one season than to present what must be considered an imperfect view of so important a county.

Whoever has travelled during the summer from Port-Kent to the Canada line, along the main road, cannot have failed to remark the excellence of the soil and the favorable make of the country for agricultural purposes. Probably there is no better soil in the State than that of Peru, Chazy and Champlain. It is composed of a due intermixture of the tertiary clays and sands, which nature has sometimes mingled in the proper proportion to constitute the best for agriculture; in other cases, they are placed in juxta position, prepared to the hand of the husbandman to make that mixture which, in his judgment, shall best promote his interests. Of the richness of the soil, and the favorable nature of the climate, we have an unfailing test, also in the thrifty growth and healthy state of the apple, and other fruit trees. In a cold soil and a windy district they are uniformly stinted and covered with parasites, which gives them really a gloomy aspect; but in a good soil and temperate climate they always look flourishing and green, and free from that sombre appearance they wear when their limbs and twigs are covered by a parasitic growth of lichens.

Such is the case with the fruit trees of this region, and for aught I could discover, they appeared equally flourishing with the southern productions belonging to the same species. In regard to the general fertility of the soil, and the favorable nature of the climate, the general productions of the settled portions of the county furnish ample evidence, and it will not be considered as a disparagement to any other part of the State to say, that the soil is good enough. The general surface of that portion of the county bordering the lake, and extending west ten miles, is rather uneven, though interspersed frequently with level tracts.

The rock formation is a continuation of that of Essex, described in the report of last year. The transition is, however, wider and more perfectly developed.

The general arrangement of the transition rock is as follows:—The sandstone, which is so perfectly exhibited in the great gorge at Keeseville, in it progress north, passes beneath the Trenton limestone, or as it has usually been denominated, the transition limestone. The latter rock from Port-Kent, as it continues north, skirts the lake the whole length of the county, and extends west five or six miles. The sandstone at this distance makes its appearance by emerging from beneath the limestone, and may be traced farther west for the distance of five miles. Beneath this are the primary rocks. We have then a broad belt of the old transition rocks extending north the whole length of the county, and west from Lake Champlain about ten miles. This general statement requires a single modification, viz: that the transition passes around the great primary chain of mountains at the north, and they therefore ex tend into Franklin county without any interruption; and we may pass into Franklin, or even St. Lawrence county, on the great transition formation, without encountering the primary rocks.

From this statement it will be perceived that the axis of the primary mountains terminates south of the provincial line. The whole range slopes rather abruptly as it continues on the north side of the boundary, but soon disappears entirely, or is lost in the perfect levels of Lower Canada. The termination of the northern highlands of New-York is Covey hill, over which there is a good road running nearly parallel with the provincial line and about two miles north of it. Having attained the summit of this ridge on the Canada side, the traveller may view the whole of that triangular portion of country lying between the St. Lawrence and the Sorel rivers; it is spread before him as on a map. The whole appears, with trifling exceptions, as a vast wooded plain, presenting to the eye an agreeable variegation of water, dark and light shades of forest trees, and skirtings of blue mountains in the distance, in sufficient profusion to produce as fine a landscape as the lover of nature can wish.

The most remarkable phenomena of the transition rocks occur in connexion with the sandstone. They consist in fissures more or less deep, running through the rock in various directions. One of the most remarkable of them occurs at Covey hill, or as it is more usually called on the New-York side, at the *Flat rock*. This fissure, or gulph, is about half a mile in length and sixteen rods wide, and is bounded by perpendicular walls of sandstone. A small stream runs through it and forms in the gulph a small deep lake. The distance from the surface to the water, as measured by Dr. Churchill of Champlain, is 150 feet—the depth of water 150 feet. The direction of fracture is north 70° west.

The rock dips from each side of the fracture at a very small angle.—Flat rock is more or less a conglomerate, and is generally a coarser sandstone than the variety at Potsdam or Keeseville. It occupies an area of several miles, and presents quite a remarkable aspect. It is covered mostly with low shrubs and whortle bushes, with here and there a solitary tree which has monopolized a little more earth than its humble neighbors.

Economical Productions.

Under this head I shall speak of a few only, and those which are of the most value.

Sandstone for glass.—The sandstone which lies along the borders of this formation and near the primary rock is often of a pure white, it possesses a loose granular texture, which is often increased by weathering, it then passes into a sandy variety. In this state or condition the rock furnishes an important material for glass, and is extensively employed in its manufacture. The most important localities which fell under my own observation were in the township of Mooers. The material is abundant and of the best quality.

Black marble.—A valuable quarry of black marble exists in Chazy, near the lake, and nearly opposite Isle La Motte. It is probably a continuation of the same stratum, which is quarried upon the island. The same stratum, I have observed at other localities. It furnishes a jet black surface, and receives a beautiful polish, and is, altogether a fine production.

The same varieties of the transition marbles are more or less abundant on Valcour's island. It is scarcely necessary to add, that this marble district is capable of furnishing lime to any amount, either for masonry or agriculture. There is one difficulty in raising the limestone, which it is important to bear in mind, viz: the small dip of the rock, or its nearly horizontal position; the expense and difficulty is consequently increased.

Iron ores.—After what has been published in the preceding reports it is scarcely necessary to enter upon a detailed account of the ores of Clinton. It will be sufficient to refer to those reports with this remark, that by far the larger proportion of ore beds exist in the south part of the county, in the neighborhood of Clintonville, Keeseville and in the vicinity of the forks of the Au Sable. There are as many as a dozen beds in this region, some of which are known the world over for the excellence of the iron which they furnish.

One great item of expense which the proprietors of those works have to encounter, is that for transportation of the ore, and of the iron and coal. No relief can be offered to meet or diminish this expense, except the construction of a rail-way. This matter becomes more important every day. The general effect on this region would be the concentration of important establishments at central points along the line of the rail-way; an arrangement which accommodates the public, and is more convenient for those who are engaged in them.

Another variety of iron ore occurs on the head waters of the Saranac. It is the bog ore. Its abundance has not been fully ascertained; but the structure of the county, the nature of the rocks, &c. indicate an abundance of it. Its value for mixing with the harder ores, and also for the production of soft malleable iron, is too well known to require any remarks from me. It is a matter of congratulation to the inhabitants of this truly mining district, that the surrounding country is fertile and productive in the most useful vegetables; so much so that the manufacturing classes must be greatly increased before the country will be unable to furnish the materials for the support of the population.

Changes of the Surface, &c.

The most conspicuous changes which have occurred in Clinton county, and which are confined to the surface, are ridges of pebbles, which have been thrown up by the lake in ancient times. The continuity of those ridges has been broken, and it is difficult to trace them continuously many miles. They are similar to the famous ridge which runs parallel to Lake Ontario, and were probably produced by the same causes, and at the same period. Sand and gravel are raised at the present day by the pressure of ice and the action of waves.

The present existence of those barriers indicate very clearly the former extent of the lake. One of those ridges is crossed by the main road near the village, in Beekmantown. Their general direction is north and south, or nearly parallel with the lake. Theoretical considerations connected with this subject are among the most important in geology. It is not my purpose, however, to present any remarks of this kind at the present time; the subject was partially discussed in my report for last year, under the head of tertiary formations of Essex county.

Remotely connected with phenomena of this nature, is the transportation of rocks, gravel and sand, diluvial scratches, &c. One remarkable instance of transportation fell under my notice on ascending Raven's hill, near Elizabethtown, in the occurrence of boulders of sandstone near its summit. They were full 2,000 feet above Lake Champlain. They are not numerous, but sufficiently abundant and large to prove unquestionably their transportation by other means than human.

Scratches and diluvial grooves are every where to be seen on the rocks through this whole section of country. Their general course is north and south. The cause of phenomena of this kind seems to be uniformly referred by geologists to currents which in former times have swept over those sections of country where they occur, or to the passage of icebergs loaded with stones and rocks, when it was beneath an ocean. Not only are the flat or horizontal surfaces marked and grooved, but also those which are perpendicular or at right angles to the horizon. Remarkable instances of this latter occur between West-Port and Port-Henry, in Essex county.

WARREN COUNTY.

Warren county is strictly a mountainous district. It is traversed on the southeast corner by the Palmertown range of mountains, and through its eastern portion by the Kayaderosseras range, quite its whole length. Its western side is occupied by the Sacondaga mountains, which are extremely rugged and precipitous. The highest and most remarkable mountain in the county is Crane's mountain, in Johnsburgh. It is upwards of 3,000 feet above the plains of Warrensburgh. Its superior outline is quite remarkable, exhibiting from whatever point it is viewed, a striking resemblance to the human face. This resemblance arises from the remarkable uplifts of the rock of which it is composed. The prospect from the higher class of mountains in Warren county is quite imposing, as from their summits the great ranges of mountains traversing the northern portion of the State, together with the Green mountains of Vermont, are distinctly in view. Crane's mountain, in Johnsburgh, and Harrington's hill, in Warrensburgh, by their position and height, command an extensive field for observation, and are very advantageously located for conducting a trigonometrical survey. The great group of the Adirondacks are very distinctly seen during clear weather from Harrington's hill, almost due north from the observer, together with the remarkable ragged ridge lying to the east, and which passes through township 29, and onward through the eastern border of Keene. The lover of mountain scenery will not fail of visiting Harrington's hill, when in its neighborhood; it is easy to ascend, and in fact a carriage might be driven to its summit.

The geology of Warren county is quite simple. By far the largest portion is gneiss. A part of Queensbury is underlayed by the Trenton limestone. It is found, also, at Caldwell and Bolton, skirting for a few rods in width the border of Lake George. The character and value of this rock has already been spoken of under the head of marble.

Gneiss and hornblende are the predominant rocks; subordinate to them are beds and veins of serpentine, primitive limestone, and a mixture of the two constituting the peculiar marble which has already been noticed. The Kayaderosseras range is composed of gneiss very distinctly characterized. Veins of coarse granite frequently traverse it, and which sometimes spread out into beds of irregular width. It never occurs in masses sufficiently heavy to impart a granitic character to any portion of the county.

The soil of Warren county is sufficiently productive to answer all the ends of the husbandman. It is mostly diluvial, and is made of gravel and loam combined in such proportions as to form a strong soil well adapted to grass and English grain.

The predominance of the diluvial beds gives an interesting character to the whole county. The extent and depth of those beds, together with their frequent occurrence in rounded and conical hills, or their extension in prolonged narrow ridges for miles in extent, give evidence of former agencies which cannot be mistaken. I may here remark, that the lower valleys and those adjacent to the primary rocks, or lying between the transition and primary, present those accumulations of gravel and boulders* into conical hills and waving ridges, far more distinctly than any other sections of the country. In fact, though it would not be proper to say that the primary is bordered by diluvial hills, still this constant occurrence along certain lines, and those mostly which lie along the base of the primitive hills, will arrest the attention of the observer. The particular constituents of those gravel hills merit attention. I found them composed generally of particles of the adjacent rocks. Thus, through the township of Lewis, in Essex county, those hills are made up mostly of particles of the hypersthene rocks, and at least two-thirds of all those accumulations of gravel in the whole northern section are composed of the same materials Hence they have not been brought from a distant region, but have been furnished in the immediate vicinity of the place where they are now deposited. The tertiary in this county is quite limited, and is confined to the borders of Lake George and the North river. It is the most extensive in Queensbury, and constitutes a valuable section of country; the soil is light and sandy; it is still susceptible of the highest cultivation, and may be made to produce abundant crops.

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* A remarkable boulder exists in Warrensburgh, near the bridge. It is about 30 feet in height and 80 feet in circumference. It is entirely above the ordinary diluvial of the country. It forms a very remarkable monument of the powerful agencies which were in operation in ancient times.

Primitive Limestone.

Warren county is apparently traversed by a ridge of limestone. Its course is nearly east and west. Its continuity is often broken or interrupted by other rocks. We cannot, therefore, trace it continuously. Still its occurrence in this direction at intervals furnishes proof of the direction in which it has been more generally produced. In this respect those veins or beds are analagous to the greenstone dykes, which are so prevalent in the hypersthene rock. The limestone is generally coarse, and mixed more or less with coccolite and hornblende. Its purity, however, is such that it forms a useful material for lime. I have found it in sufficient abundance in all the towns of the county to meet the wants of the community. It is unnecessary to describe or point out the numerous localities at which it occurs.

A remarkable fact connected with this formation may with propriety be mentioned: it is the occurrence of caves in it in Athol, and, as I have learnt, also in Minerva, in Essex county. Those caves are situate on the North river, about two miles from Warrensburgh. They are from 100 to 150 feet above the river, and as would be conjectured, are evidently produced by water. Their entire extent has never been ascertained. Persons have explored them for upwards of a hundred feet.

The period at which those caves were formed was anterior to the accumulations of the gravel already noticed. This statement is supported by the fact that the openings or mouths are covered by this kind of gravel, and they have generally been discovered in consequence of the falling in of cattle while passing over them. In some instances boulders of rocks foreign to the region are wedged into those openings, and partially close them. They have no other interest than the evidence they furnish of the period when they were produced, and of the agent which was the immediate cause of their production. They contain no remains of organic beings, so far as discoveries have yet been made.

Magnetic Oxide of Iron.

Some important localities of iron ore have been discovered in this county. One in particular on lot No. 80, in Hyde Township. Portions of the ore are mixed with sulphuret of iron, which without roasting and exposure to the atmosphere, would form that variety of iron which is denominated cold short. Much of the bed is free from sulphur, and will undoubtedly form an excellent iron. Beds of iron of this species occur also in the Brant Lake tract. It presents a promising appearance, and is located in a region of wood and water, circumstances quite favorable for its reduction.

Other beds exist in Athol and Luzerne; they furnish a pure oxide, and would, if a demand existed for them, make an excellent iron. The beds of this variety of ore are generally less extensive in the gneiss than those belonging to the hypersthene rock. The latter in the northern region seems to constitute the true ferriferous formation in which the development of this ore is on the largest scale.

Another locality of magnetic iron is found in township No. 16, in the county of Essex. The quality of this bed also appears favorable to the production of good iron. It is an extensive deposit, but cannot become important until some better means of transportation shall be furnished than exists at the present time.

Marl.

An extensive deposit of marl exists in Queensbury. It is on lands owned by Mr. Jenkins, an intelligent farmer, who well knows its worth. It is procured in several marshes in that vicinity, and is generally associated with peat. It is a valuable substance, and well adapted to the soil of that region.

Generally marl is not a product of the northern counties, and there are only a few localities at which it occurs. Ground limestone may be employed as its substitute, though its use is attended with a trifling more expense than marl. Marl, however, is more valuable in itself than limestone, as it generally contains vegetable and animal matter in combination, and its immediate effects are more apparent; it is in a state of minute subdivision, and is duly prepared to become a constituent of the soil.

Having spoken at some length of several substances which occur generally in the northern counties, it will not be expected that those subjects will be resumed again in this connection. Those substances are porcelain clay, feldspar and peat. They are each of them abundant products of this county, but for particulars concerning them I refer the reader to those heads under which they are described.

Direction of Dykes, Veins, &c.

From a careful examination of the course and bearing of dykes, I have been disposed to adopt the opinion that they were produced by a cause acting uniformly, and in certain directions during a given period. The grounds on which an opinion of this kind is supported, may be gathered from the following facts: Dykes occur throughout the whole northern region, but there are a few localities at which they are numerous, and may be compared readily with each other. Of localities of this kind I will select Trembleau point in Essex county. In the immediate vicinity of this point, and within the distance of a mile, I discovered sixteen dykes. They vary in width from 2 or 3 inches to 10 feet. The average bearing is north 60° east. There are instances in which the bearing is north 80° east, and others in which it is north 40° east. Their direction is never in the line of the bearing of the strata or mountains, and wherever they belong to the primary rocks, I have never found their bearing due east and west. Though their bearing is not precisely directed to a given quarter of the horizon, still, there is a great degree of regularity within certain limits. Hence the inference, that they may have produced by some cause, acting in a given direction during a single period. A few cases of single dykes may be referred to; for instance, one two miles south from the line of Willsborough, its bearing is north 70° east; another in Warrensburgh, north 45° east; another at the foot of the mountainous ridge between Glen's falls and Jessup's landing, north 70° east; another in Johnsburgh, near Mr. Rosevelt's, north 55° east. That portion of the dyke in contact with the adjacent rock is converted into obsidian. The few facts I have now given, though not sufficient to establish a general law, are still sufficiently remarkable to merit the attention of geologists in other sections of the country.

List of Simple Minerals in the Counties of Essex and Warren.

Limonite, eupyrchroite, magnetic oxide of iron, red oxide of titanium, brown tourmaline, schorl, zircon, yenite, chiltonite, obsidian, adularia, porcelain clay, hypersthene, labradorite, chalcedony, hornblende, asbestus, serpentine, calcareous spar, apatite, pyroxene in all its varieties, garnet, colophonite, spinelle, sphene, graphite, sulphuret of copper, sulphuret of iron, black oxide of manganese, silicate of manganese, lignite, steatite, talc, mica, crystallized quartz, scapolite, tabular spar, sulphate of magnesia.

Temperature of Springs and Wells.

Spring at Johnsburgh, issuing from limestone and under cover, 44° 5′; temperature of air 81°. July 22, 1838.

Of two deep covered wells in Champlain, Clinton county, 44° & 48°; temperature of air 76°.

Of a deep well at the outlet of Schroon lake, 46°.

At Warrensburgh, 45°; air 74°. July 14.

A spring at Crown Point landing, 46°; air 56°. May 23.

Spring at East Moriah, 43°; open air 54°. May 27.

At Westport, spring, 45°; air 65°. May 31. Another, 43°; and another 40°; air 64°.

Mineral spring at Westport, 44°; air 56°. May 30. Deposits tufa.

Well at Westport, covered and in the shade, 42°; air 69°. June 1.

Variation of the Magnetic Needle.

The observations were made with a theodolite which reads to a minute of a degree. The results were obtained by observations on the pole star at a given hour in the evening. The time, though not probably the exact local time, still approximated very nearly to it, so that very little error can arise from assuming it as the true time.

Variation of the Magnetic Needle at Champlain, Clinton County, 29th June, 1838, 9° 30′; time, 9 o'clock and 30′ P. M.

At West Chazy, 9° 21′; 8 o'clock, 45′. July 3, 1838.

At Keeseville, 8° 40′; 10 o'clock, July 6, 1838.

The variation at Keeseville, in 1825, as obtained by E. F. Johnson, Esq. was 7° 30′.

At Warrensburgh, 7° 15′; 10 o'clock. July 15, 1838.

The preceding pages embrace the most important facts which have fallen under my observation during the last season. That they may contribute to the promotion of agriculture, and in some small degree to the advancement of science, is the wish of

Your most
Obedient servant,
E. EMMONS.

Albany, February 1, 1839.

THIRD ANNUAL REPORT

Of the Geological Survey of the Third District, by Lardner Vanuxem.

Montgomery, Herkimer, Oneida and Oswego, were the counties which formed the subject of the last report. It was in consequence of those counties presenting but few of the attractive valuable mineral products, those which do not enter into the composition or form rock masses, but are the associates of certain rock masses, that it was thought better to adopt a more general plan than the one contemplated at the commencement of the survey.

With few exceptions, all the mineral wealth of the Third District form portions of the great series of rock or geological masses, the right understanding of which requires that the position which each kind holds in the series, should be known. The same reasoning applies to those mineral substances which do not enter into the composition of the series, from making but a small part thereof, but have a determinate place therein; and the same likewise may be said of those products derived from certain materials of the series, and hold a position extraneous to them. Such are calcareous tufa, lake marl, bog-iron, and we may include the products of alluvium likewise.

This blending of the two methods in the annual reports, greatly facilitates the Geologist of each district in the collecting of materials for his final report, being aided not only by his own eyes, but the eyes of his co-associates. For these and other reasons, we shall continue the same plan in the present report.

It cannot be said that any of the counties have been finished or thoroughly examined, for it often happens from the materials which form rocks, having been furnished from different and often opposing geographical points, that a rock which is well developed or forms a thick mass in one county, may in its prolongation, so thin out as to attract little notice in another county, producing this result, that should the examination be commenced in the latter and not the former one, it may be passed over with but slight attention, requiring, therefore, a re-examination, before the whole series of the county can be completed. Of the truth of this remark, Western New-York furnishes some remarkable examples.

The limestone of Niagara, Lockport and Rochester, estimated by Mr. Hall, at 150 feet thick, thins out in its progress east, so as to be but two or three feet in thickness near the Sauquoit in Oneida county. The mass which lies below the limestone, the "calciferous slate," is about 80 feet thick in the western part of the Fourth District, and seems to disappear before reaching Madison county, and reciprocally the "millstone grit," which is thirty and more feet in thickness in Herkimer and Oneida, gradually attenuates in going westward, being from four to five feet at Rochester. The materials of which this rock is formed, gravel and sand, prove that their source was eastwardly. In Herkimer and in the eastern part of Oneida, the pebbles are larger and the mass thicker, the sand increasing going west, whilst the pebbles diminish in the same direction. Thus, in Cayuga the pebbles are rare, and I know not that they have been noticed in the "gray band" at Rochester, the continuation or equivalent of the "millstone grit."

The counties principally examined were Madison, Onondaga and Cayuga. The whole boundary between the Third and Fourth Districts was likewise examined conjointly with Mr. Hall. Besides, many portions of the southern counties were visited preparatory to a more thorough exploration the coming season. In this report, we shall not treat each county separately, but connect the whole, in order to avoid repetition.

Proceeding up the Mohawk valley, a rapid rise takes place to near Utica, from which point commences the long level of the Erie canal; no great change comparatively of level takes place thence proceeding west, and in a NNW direction, throughout the Third District.

Though the general upper level is attained near Utica, yet we are not upon the top of the plane, until we are a little to the west of Rome; there the waters pass in opposite directions, some to reach the ocean by Lake Ontario, others by the Mohawk and Hudson.

Where the bottom of the valley ceases to rise, its sides begin to recede from each other, and to the south and left in proceeding west over the level we have the continuation of the great elevation of Herkimer and other counties to the east, its line of continuity much broken in its progress through the Third District, owing to numerous streams of water flowing from the south. To the west and north the limits of the level lie not far from a line passing from the north of Rome through Salmon creek, in Oswego county.

The area included within the limits mentioned, presents no elevation excepting those formed by alluvial materials only, if we except the plaster hills which skirt the northern side of the great elevation, and a few other limited projections of the same great mass. The alluvial materials abound more within this area than in any other part of the Third District, consisting of clay, sand, gravel and larger stones, either filling up excavations, some at least 200 feet in depth, or rising into hills and ridges.

The area occupies a portion of Oneida, the northern parts of Madison, Onondaga and Cayuga, and the whole west and south portion of Oswego county.

Were the whole of this ancient level or area stripped of its alluvial materials, we should find that the surface presented a lake bottom, appearing as though Ontario and Oneida once had a higher level, their waters uniting and covering the whole surface. That this level or area has been the theatre of great erosive action is evident from many facts collected in the progress of the survey, facts all important to a right understanding of the salines of Onondaga; all which subsequently will be given.

In Herkimer the great southern elevation consists, as was mentioned in the second report, of the green shales, the "millstone grit," the protean group, the red shale, the water limes, the upper limestones and the " pyritiferous rocks." All the lower, or first named ones, appear merely as outcrops, forming as it were the south wall of the valley, their northern ends alone to be observed with such other parts as the small valleys or ravines which have been excavated in them have exposed. From beneath these rocks the black shale appears, and forms the bottom of the valley.

The elevation in its progress through Oneida, in consequence of the dip of its rocks to the southwest, the rise of the valley and the lower rocks rising and passing abruptly to the north from the influence of the great primary mass to the north and east, causes the green shale to appear in the area and gradually take the place of the black shale. This in its turn cedes its place in like manner in part to the "millstone grit" and the protean group, causing these two latter masses to occupy the southern half of the area. Whilst the green shale is extending itself through Oneida, other rocks appear which have no existence in Herkimer. These rocks commence between Utica and Rome, and cover the northern side of the area. They appear from under the "millstone grit," and from above the green shale of Herkimer, and of the same rock in the creek to the east of Utica, or in other words, from between the two rocks. These rocks are the shales and green sandstone of Salmon river, and the red sandstone of Oswego; they cover a considerable portion of the north part of Oneida, the greater part of Oswego, and the red sandstone forms the triangle in the northern part of Stirling, in Cayuga, appearing immediately under the "grit."

The further progress of the elevation causes in Madison, another change; the red shale which rests upon the protean group, adds another member to the area. With the exception of the curve from Rome, the entire length of the Erie canal in that county is excavated in the red shale. And the final progression of the elevation in the Third District, causes portions of the gypseous hills of Onondaga and Cayuga, they being the equivalents of the water limes east of Oneida creek, to form as it were portions of the same plain. With the Third District, our observations should end; but a general idea of the whole elevation is required, in order that the report of the salines of Onondaga should be fully understood, and all doubts as to the superposition of the rocks should be removed, which could not be, unless the whole range should be given. Besides it may be said, that no part of the geology of New-York, judging from what has been written, is more obscure than the part we are treating, and its importance requires all the light that can be thrown upon it.

Near the Cayuga lake, the rocks are at their point of greatest depression, and from thence rise, going west. The effect of which is to cause all those rocks which underlie or compose the area or depression to again reappear as an elevation.

Thus the red sandstone of Oswego which covers the triangle in Stirling, Cayuga, which cannot be over 15 feet above Lake Ontario, forms the lower falls of Rochester, rising nearly 100 feet above that level. The red sandstone is followed by the gray sandstone, quarried near the line of the county, between Martville and Hannibalville, and of Hulme's quarry in Stirling, being the "millstone grit" of Oneida, and the "gray band" of Rochester. The rocks succeeding to the grit, are the green shales, the iron ore beds, the calcareous " fire stones," &c. &c. of the protean group; the whole terminated by its upper member, the concretionary rock of Oneida, which with its immediate associates appear in the low level near Oneida lake, passing thence through the towns of Cicero, Clay, Lysander, Ira, and Victory, in Onondaga and Cayuga, thence onwardly, and finally forming the upper falls of Rochester, the rock of the great excavation of Lockport and the falls of Niagara.

From the information obtained from Mr. Hall, of the geology of the north side of Lake Ontario, we learn that the southern limit of the Birdseye and the Trenton limestone is near Newcastle, opposite to Rochester; and the southern limit of the shales of Salmon river is at Credit river, about fifteen miles west of Toronto; both extending westward in the same direction as in this State. From these facts we are enabled to solve points of the highest importance, and as obscure as were the connection of the series of rocks which form the great south elevation of the Mohawk valley, with those of the middle region and those of the mountain ridge or terrace of Niagara.

Red Sandstone of Oswego.

The red sandstone of Oswego is the lowest rock of the three counties whose examination forms the subject of this report. The counties are, Madison, Onondaga and Cayuga. The red sandstone is only found in Cayuga in the town of Stirling, underlying the north half of the town. It is not to be seen in many places, owing to its alluvial covering. The locality where it is uncovered to the greatest extent, is on Little Sodus creek, at Stirling centre, where it is likewise quarried for building. From the centre it extends along the creek to McFarlane's mill, a mile south. At the centre, a brine spring rises by the side of the creek, through a fissure in the sandstone. There is another spring also near the mill. At both places, salt was made, and of similar quality; both had a sharp taste; that of Stirling centre was highly coloured with iron, which mineral the spring deposits. Care being taken to purify the salt at the mill as to colour, it was white.

The red sandstone is the lowest rock, geologically, of New-York, which contain brine springs of sufficient purity to be manufactured into salt. From the eastern part of Oswego county, to the Niagara river, numerous brine springs are found in this red sandstone.* All the springs in the Third District, which are found in this rock, and there are several in Oswego, yield the same kind of sharp tasted salt, described as the salt petre taste, and all highly coloured with iron; characters different from the salt of the brine springs which belong to a subsequent deposit, and show a difference of source or contamination from being deposited with a different rock.

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*See Report of Fourth District.

Near Little Sodus bay there is another salt spring, which must arise from this rock. It is not far distant from the one described in the first report of this district.

Gray Sandstone of Cayuga.

To the south of the red sandstone, and reposing upon it, is a gray sandstone, the lower part often variegated with the red oxide of iron, and the upper variegated with green shale, resembling a coarse kind of "fret work." This mass for position corresponds with the "mill stone grit" to the east, and the "gray band" to the west. It is quarried in two places. One quarry, owned by Mr. Bentley, on the road between Martville and Hannibalville; the other by Mr. Hulme, and is between Little-Sodus creek and the line of Wayne county.

Protean Group.

The gray sandstone is followed to the south by a series of green shales, with thin layers of sandstone with fucoids, with thin layers of fossiliferous limestone used as firestones, and with the red oxide of iron, the well known products of the protean group. These products are best seen on Little Sodus creek, at Martville, and for about half a mile lower down the creek; also along the south shore of Oneida lake, commencing on the farm of Robert Bushnell, west of Joscelin corners; at the corners, and likewise at Oneida post-office. From thence eastward, from being buried under the alluvial, or more probably washed away, they do not appear until near Verona, excepting on the land of Thomas Donnelly, on the road between Canastota and the State bridge.

The iron, which is the same in kind with the Verona and Westmoreland ore, designated in the report of Dr. Beck as the "lenticular clay iron ore," is found in Cayuga to the south of Hulme's sandstone quarry, on the farm of Peter P. Van Patten. It occurs on and near the surface, fragments being often ploughed up. This bed seems to be the lower, or the Rochester mass, and not the one near the Wolcott furnace, which is the second mass. Iron ore of the same kind is said to be found in the creek near Martville, which I had not time to find, the locality being a secret. I have no doubt that it exists there, for the rock in the bed of the creek at the village, corresponds with the roof of the ore bed at Wolcott furnace, and the roof of the ore bed worked for the Tayberg, Lenox and Constantia furnaces, near Verona, and will be found between the village and the mill, a half a mile below. No ore has yet been found in Onondaga, the first indication east being in Madison, at Robert Bushnell's, in the loose materials of the bank above his stone quarry on the lake shore; again about three-fourths of a mile beyond, at Joscelin corners, between the road and the lake. It appears to be in two layers, over a foot each, and of pretty good quality. It is exposed along a line nearly horizontal, of several hundred feet in length. This ore, it was said, was taken to Constantia furnace, but no very favorable opinion of it given; probably owing to the specimens having been taken from masses which had for ages rested upon the surface, and had resisted all change, owing to carbonate of lime, which is an associate of this ore, and to which its hardness is principally owing. Had excavations been made, and the softer varieties been chosen, a different opinion would have been given. So far as the eye could determine, I was satisfied that much of the ore which was exposed upon the surface, so far as a judgment from the eye could be formed, seemed to me to be little inferior to the Verona and Westmoreland ore, and fully equal to the ore of the same kind quarried in Pennsylvania, near Danville, on the Susquehannah.*

Indications of the same red ore appear in the bank of the lake, on Mr. Munger's farm, at Oneida Lake post-office.

All the localities on the lake shore are in a right line, but from thence the line in which the ore is found is on a curve, passing to Verona. The ore being on the farm of Thomas Donnelly, in the town of Lenox. It is generally found below the surface about plough deep. Many masses have been thrown up, some lying loose, others piled up. It is in solid masses and in a state of disintegration, colouring the surface of the ground of a blood red. This is the purest kind, the carbonate of lime having been removed by solution in water. The ore covers an area of about 80 or 100 acres, slightly raised above the adjoining alluvial land on its north, east and west border. The solidity of the ore appears to be the cause of its not having been swept away with its original associates and its superincumbent masses.

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* The ore near Danville corresponds in its fossils with the second bed, that is, Donnelly's in Lennox, Bennett's in Westmoreland, and the bed which once existed above the Tayberg, Constantia and Lenox bed in Verona, which has been destroyed; but the numerous masses and fragments which have been uncovered in grading the rail-road, show that it had there existed. The common or prominent fossils, are the Strophemena rugosa, Atrypa affinis, Leptæna punctulifera, &c. &c. The encrinal rings with their peculiar rounded edges proving partial solution, are common to the beds of both States, and the characteristic fucoid of the protean group is found just below Danville. The perfect identity of the Pennsylvania and New-York bed show the extent of this thin deposition. It has long been known that the iron ore beds in New-York extended from Herkimer to the Genesee river, and now we know that one of them extends south 160 miles.

From all observations made, it is certain, that there are two distinct beds of red oxide of iron in the protean group, arranged in lines parallel to each other, extending from Herkimer to the Genesee river. These beds are about 25 feet from each other, and from 1 to 2½ feet in thickness. They are not always present in every locality, for sometimes the one and sometimes the other, and even both, are wanting. A circumstance readily conceivable over so great an extent, with masses comparatively thin, where opposing currents both general and partial may have existed, and where the surface over which the iron was floated may not have been level.

It has happened, no doubt, frequently, that the surface over which the iron was floated admitted of its fine particles to escape, that is, to be absorbed by the floor upon which it was deposited. In this way we can explain the stains of iron upon the shales of Little Sodus bay, and of the mill at Martville, &c. &c. A whole bed could not disappear unless passing over coarse sand, for the grains of which the greater part of the ore consists, must have been formed at the point of Thermal action.

The concretionary limestone and its blue shale, as was made known in the second report, terminate this group. The limestone is first met with on the farms of Mr. Hood and Capt. Adams, south of Donnelly's ore bed. The shale and a more compact kind of limestone, were thrown out in digging a well between Donnelly's and the concretionary rock. Near to Joscelin's corners, on the farm of Enos Hubbard, it is burned for lime; so also in most of the towns of the Third District through which it passes. This limestone is readily known by its well defined characters, and is readily traced by its numerous quarries opened in the towns of Cicero, Lysander, Ira and Victory, all which are arranged in nearly an east and west line.

In some of the quarries of the limestone there are small geodes whose sides are lined with crystals of carbonate of lime as at Lockport; in others, but more rarely, the limestone encloses globuliform masses of pure white gypsum, and in others we find that singular concretionary rock which forms the upper part of the Lockport and Niagara limestone, being the terminal mass in the Third District, and from which its name was in part derived. In the upper part of the concretionary limestone, oolite is often found, showing that some of its particles were subjected to the same cause which gave rise to this appearance common to the iron ore of the group.

Of the fossils of this rock, there are two which have been found only in this rock. The Orthis bicostata is abundant, occuring in Oneida, Onondaga and Cayuga. The other is the Pterinea gibbosa, which is not common or abundant.

Red Shale and the Water Limes of Herkimer and Oneida,
which we shall call in this report, the *saliferous group of Onondaga.*

This group comprises four deposits, between which there are no well defined lines of division, but for practical purposes, the divisions are obvious enough.

The first or lowest is the red shale; 2d. The lower gypseous shales, the lower part intermixed with the red shale, the red shale ceasing entirely with this mass; 3d. The gypseous deposit, which embraces the great masses quarried for plaster, the hopper shaped cavities, the " vermicular limerock " of Eaton, and other porous rocks; and 4th, and lastly. Those rocks which abound in groups of needle form cavities, placed side by side, caused by the crystallization of sulphate of magnesia, which may, from that circumstance, be called the magnesian deposit.

These masses occur from the eastern part of Madison to the extreme western limit of the Third District.

The whole of the group, leaving out its gypseous and magnesian constituents, may be stated generally, to be of argillaceous materials, meaning thereby, silex and alumine in the state of indurated clay, and of carbonate of lime. The former abounding in the lower or red shale mass, diminishing upwards, whilst the carbonate of lime which is but perceptible in the lower part, increases and is in great excess towards the upper part.

From the limestone of the protean group, we pass, going south by a few thin beds of alternating green and red shale, and a thin bed of hard green sandstone, to the great mass of the red shale. At least such are the results of observation throughout the counties of Herkimer and Oneida, where these masses are presented in the wall of the great elevation, and we have no reason to believe that any change has taken place, other than a thickening or thinning of some of the lower beds, not knowing as yet with certainty the direction from whence the whole of the materials of those beds were derived.

That the red shale increases in thickness going east from Herkimer, is certain; but the point of its greatest thickness is not ascertained. The boring now in progress at Salina may furnish information that will determine it.

The red shale forms the base or lowest mass of the salt springs found along the course of the Erie canal, in the Third District, and has often been confounded with the red sandstone of Oswego, and its prolongation the sandstone of Rochester and Niagara. The two rocks have no connection with each other, being separated by the protean group, nor resemblance, excepting that the same ferruginous material colours them both, and both are connected with saliferous sources.

With the exception of the curve which the Erie canal makes in its entrance into Madison from Rome, its whole course in that county has been excavated in the red shale. From the canal pursuing a more southern route in Cayuga, and from the dipping of the red shale to the southwest, we find that only in a few places in Onondaga, where the canal curves to the north, that it traverses the red shale. These points are its entrance from Madison towards Kirkville, the curve at Bellisle, and the great curve which passes by Canton to Jordan. Near to Jordan, the red shale is exposed on both sides of the canal for a mile or more.

The red shale, with its green spots, noticed in the report of last year as existing to the east of Vernon Centre, is well exposed in the road leading to Oneida Castle.

The same variety exists at Salina on the north side of the canal on the road to Liverpool. Likewise at Baldwinsville, the canal there being excavated in this kind of red shale. The green spots frequently present a nucleus in the centre. When examined by the microscope, the green spots exhibit points which seem to be iron in a lower state of oxidation. Some of the shale is mottled or marbled, some hard, but all the different kinds here as in other parts of the district, speedily crumble by exposure to atmospheric agents.

A boring in the red shale, made by Seth Hunt, for salt water, near to the salt spring noticed by Dr. Beck, at Lenox, on the land of Capt. Clark, presents several important facts. The depth attained was 196 feet, 190 in red shale, and 6 feet in hard green sandstone, which took several days to bore the six feet. When the boring commenced, the saltness by the instrument used was 2½°, and towards the close 9°. No stream of water was met with. It was abandoned on account of the breaking of the auger, which could not be extracted. This information was communicated by Capt. Clark.

This boring proves that the red shale increases greatly in thickness in its progress west from Herkimer. So far as judgment could be formed from the eye, supposing the dip not to be great, its thickness at Lenox could not be less than about 400 feet. The boring exists in a depression to the north of the canal; the hills to the south of it, which are of red shale, are about 200, giving a total thickness of nearly 400 feet.

The red shale, though of great extent, traversing the counties of Herkimer, Oneida, Madison, Onondaga and Cayuga, of the Third District, presenting a thickness of from 1 to 400 feet, yet no where has a fossil been discovered in it, or a pebble, that I am aware of, or any thing extraneous, excepting a few thin layers of sandstone, and its different coloured shales.

Second Deposit.

It was mentioned in the second report of this district, that the upper part of the red shale was far more varied than the lower part, owing to its layers or beds intermixing or alternating with those of the mass above. On the road towards Lenox from Clockville, near the turnpike, there is one of the best localities for the observance of the various alternation of the different coloured shales. Thus we have at top of the mass in descending by the road, the green, then red below it, green, red, blue, green and yellow, this latter by exposure to the air; then red and green in thin layers, being several repetitions, and finally red the lowest visible mass.

This second deposit seems to be very variable as to the colour of its shales. In some red predominates, in others the green, bluish and gray, and in some the red is wanting altogether. In this deposit, gypsum frequently occurs in fibrous masses, either reddish or of a salmon colour; colours peculiar to this deposit. The quantity of gypsum in this deposit seems to be limited; all the quarries I saw belonged to the third deposit. It is in recent excavations that we have the best opportunity of examining the product of this mass, in consequence of the ready alteration which some of the shales undergo by exposure to the air.

Near to Sodom lake, on the rise of a hill about 50 feet above the canal, and on the road from the foot of the lake to Manlius Centre, Eliakim Smith had commenced a large well for water in this mass. The rock passed through gray and greenish marl, with white and red fibrous gypsum. All the products thrown out were like those which I saw in the digging for salt water in the salt valley near Abingdon, Virginia. The same products, too, were obtained in another well about 55 feet deep, on the road to Orville, about a mile east of Syracuse, and are observable likewise in the road descending to Orville from the latter village.

The second and third deposits of the saliferous group of Onondaga have a common character, that of being exceeding permeable to water. This fluid cannot be obtained on any of the hills composed of either mass where the well sinks into them, unless sunk to the level of the water courses; a fact which readily explains the absence of all brine springs above the water level of the country.

Though I dilligently sought for fossils, knowing, from twenty years' experience, that their importance was paramount in Geology, yet it was only in one spot that I succeeded in discovering some. They were a Cytherina, about half the size of those found in the upper and lower groups. They occur in a thin layer of "calciferous slate" of Professor Eaton, those thin drab-coloured layers which make up so large a portion of the third deposit, and the upper part of the second deposit. The locality is near the top of a hill going by the south side of the canal from Jordan to Peru. In descending the hill towards the lower part, repeated alternations of red and green shales occur, characteristic of the union of the first and second deposits.

Third, or Gypseous Deposit.

This is the most valuable mineral deposit of the Third District, and the most important, not only on account of its "plaster beds," but because it is only in this deposit that we have positive evidence that *salt* has existed in this group in a solid state; and that it is the only known source from whence the brine springs of Onondaga and Cayuga could have been derived.

Besides those primary products, gypsum and salt, there are others but of little comparative importance, excepting to those to whom a knowledge of proximate geological causes is a predominant feeling. These products are the "vermicular rock" of Prof. Eaton and other analogous ones. These products throw the greatest light upon the origin of the saline materials of the group, and of the whole group we would say, were this not a practical report. These products furnish a series of facts, when well considered, will contribute more towards connecting those causes called volcanic action, now in operation, with similar causes, which must have existed and operated from the time that there was a solid crust, but operating with materials differing from those now generally used, would produce different products, and the greater the difference of material, and the greater the difference of age from causes hereafter to be mentioned, the greater would be the difference in the products; and hence the great difficulty of recognizing the products of volcanic action beyond a limited period.

That difference of age causes the products of volcanic action to be different, is evident in the ancient province of Auvergne, in France. There there are three distinct eras or ages of volcanic action, each different from the other. The first or oldest, formed of porphyries and other feldspathic rock; the second of basalts; the third and last of "gray lavas." This latter kind alone in currents and connected with craters. When, too, we bear in mind that the state of the earth's surface was wonderfully different from which it now is, and at no very remote period; nay, that even in comparatively recent times, "the mountains were brought forth," we are not surprised that we so quickly find ourselves at fault when we endeavor to extend our actual knowledge of known volcanic action beyond the tertiary periods.

The great mass which encloses the "gypsum beds," is the "calciferous slate" of Prof. Eaton, a name which he had likewise applied to a somewhat similar, but high fossiliferous deposit which is placed between the layers which contain the iron ore beds and the concretionary or Lockport limestone mass. The two slates so different from each other were considered to be one and the same; nor need we wonder at their union, since few are the observers that have not fallen into a like error. These "slates" of the gypseous beds, bear a strong resemblance in their drab colour, the thinness of their layers, by their composition of carbonate of lime and argillaceous matter with the deposits which form the plains of the table lands of Mexico, and the saline materials of both point to causes of a like nature.

The gypsum in no part of the Third District form layers or beds; on the contrary, it occurs in insulated masses, as though the particles of each mass had been attracted by a common centre, but greatly modified by disturbing causes. There seems to be two distinct ranges of "plaster beds," generally separated by the " vermicular rock," the " hopper shaped cavities," and other but less characteristic masses.

There is a somewhat impure limestone which forms a part of the third and probably of the second deposit, not being able to assign one fixed position for it. It has a peculiar appearance when weathered, like that of having been hacked by a cutting instrument, and with some regularity. This is caused by cracks in two directions, giving a rhombic surface. Solution taking place at the cracks, and the cracks not being continuous nor regular as to distance, the appearance above mentioned is produced. The stone readily breaks in the direction of the furrows, and the fracture shows stains or marks of infiltration.

Gypsum, or plaster, is extensively quarried in Madison and Onondaga counties, along the line of the Erie canal, but in Cayuga there is little plaster obtained excepting on its lake shore.

In Madison, all the plaster quarries are in the towns of Lenox and Sullivan, and all to the south of the Erie canal. Those of Lenox, on the Cowassalon creek, are Cobb's, Merrill's and Wright's. On the small creek which passes by Clockville and reunites with the Cowassalon, are the quarries of Judge Seeler and Mr. Lawrence. In the same broad range with these to the west, are those of Kennedy, Brown, Bull & Kellogg, &c. &c. In Sullivan, I examined only those near the village of Chittenango, the old Sullivan or old Patrick bed, which belongs to the first or lower range being to the east and north of the village, and Van Valkenburgh's, which is on the creek road to the falls, and belongs to the upper mass.

The old Sullivan bed was the first plaster mass that was discovered. It was worked during the war, and the plaster was sent to the Hudson and to Philadelphia. It is not now worked, in consequence of the thickness of rock or calciferous materials which cover the plaster. The following diagram will show the contents of the quarry at the west end of the hill.

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1. " Vermicular rock, 2½ to 3 feet, pores large. In the quarry east, the pores are large and small

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2. Mass of an olive colour, much altered, 2 feet thick.

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3. Variegated drab and blueish like marble, slaty as to layers, with numerous oblique cracks, 10 feet thick.

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4. Dark olive and brown mass, much altered, 20 feet to the bottom. In this the plaster was quarried, and when last worked, at the lower part.

Bull's quarry, to the left of the road from Sullivan or Canaseraga to Clockville, is one of more interest. It is like the old Sullivan, in having a thick, superimposed mass upon the plaster, which consequently diminishes its value, from the expense of working being too great, requiring the whole of materials which covers the plaster to be removed. The owners, therefore, of such beds cannot compete with those whose gypseus masses are near to the surface of the soil. The following section of the quarry shows an addition of more "vermicular," or porous rock, and the presence of hopper shaped cavities and fossil remains.

7. Third or upper alluvial of Chittenango.

6. Porous blue limestone rock, ("vermicular,") pores larger than usual, and slightly compressed, 3 feet.

5. Slaty, variegated, gray and blue striped, &c. with a few fossils. This mass is the same, with No. 3, of old Sullivan, 10 feet.

4. Thin layers brownish, with a few pores, the whole seeming to be decomposed, 3 feet.

3. Thicker layers, harder, not so dark coloured, with hoppers, and at its intersection with No. 4, the lower porous mass, pores small, 4 feet.

2. Light coloured, like No. 3, with hoppers, 2 feet thick.

1. Like No. 4, dark coloured, with gypsum; the mass to which the lower gypsum seems to be confined.

The fossils are few in number, consisting of fucoides resembling our small spear grasses, if charred; also a few bivalve shells, the lingula limosa, and two or three undescribed thin shelled bivalves.

In this quarry we are presented with a phenomenon observable in the greater number of plaster quarries of the lower range, and to which in part the common opinion entertained, that plaster is still growing, owes its origin. This appearance is an arching of the layers which cover the plaster, which is more or less regular, as the surface of the plaster curved with more or less regularity. It is usually the case that the mass or rock of the arch is full of cracks, owing to the force exerted by the plaster in its expansion upwards.

On the top of the hill to the right, going to Clockville, are the "plaster beds" of Mr. Brown, about a mile and a quarter from Clockville. The quarries present a range of detached masses more or less round upon the top, but generally smaller and with a flat surface below. The whole of the gypsum is enclosed in the usual thin layers of dark brownish, and apparently a much altered rock. Above the gypsum are a few of those which immediately overlie it, exhibiting the hopper shaped cavities, and the porous or "vermicular" rock, but all in no great quantity, some of the plaster masses being at no great depth below the soil.

The plaster hills range from east to west through the county, extending south of the turnpike for above three miles. The hills are more or less round, rendering some portions of their plaster accessible, the layers in which the masses exist having but a slight inclination.

In Onondaga there are some appearances of working for plaster at the north ends of the hills at Hartsville, and L. H. Roach works a plaster bed in the village. He remarked that there were as many as three courses of plaster. I saw no hoppers or porous rock in his quarry, but there were fragments amongst the rubbish around.

Further west on the turnpike towards Syracuse, are the quarries of Groves and Everson. Besides these quarries in Manlius, are those of Balsley, Potter and King.

In the town of De Witt we have the quarries of Dunlap, Brewster, Wilcox, Burks, Dr. Smith, Edwards, Hurd, Reals, Rumley, and of Hungerford. This latter exhibits the best gypsum that I saw in Onondaga. It belongs, I should judge, to the upper range; it has no porous rock, and was followed about 12 feet above by the terminal mass of the group. This quarry presents a fine arching over the gypsum, the elevation being considerable, and the arch unbroken. This elevation of the layers is an unerring guide in the search for gypsum; it exists in no part of the range without a plaster mass being under it. Hungerford's quarry is about a mile or two below Jamesville, on the road to Orville.

After leaving the town of De Witt, there are few plaster beds that are opened to the west in Onondaga. The greatest quantity that is regularly quarried is by the rail-road that goes to Split rock. The next that I saw was that of Mr. Hunt's to the southwest of Syracuse, near Onondaga valley.

The greatest exposition of plaster is along the Nine Mile creek from Camillus to a mile or two beyond the great embankment. The plaster beds were laid open by the grading of the rail-road from Syracuse to Auburn. Here the dark coloured mass which encloses the lowest range can be well observed for some distance; also the hopper cavities which are above that mass; they are followed by gypsum, and lastly the porous or "vermicular rock," forms the upper part of the whole. This latter is four feet thick.

Throughout the three counties where plaster exists, I have no reason to believe that it is more abundant in one part than in another part, the difference being merely apparent arising from the greater ease of extraction, caused by denudation, which by removing the superincumbent portions, admitted also of less accumulation of rubbish upon the hill sides.

Some idea of the quantity of plaster which the region contains, may be formed by the report of the engineer of the Syracuse rail-road, Mr. Edwin F. Johnson, dated June, 1837. The whole of the plaster was obtained from the hill side going from Camillus to Auburn, and to that period "about 40,000 tons had been obtained, estimated to be worth, in the aggregate, $35,000." Mr. Johnson further remarks, "that the location of the rail-road is such, that the gypsum is exposed at various points in the excavations for the distance of five or six miles. In some places the bed of the rail-road is composed entirely of that material."

Very little plaster is quarried between Nine Mile creek and Owasco river, and no quarry opened in Elbridge or Brutus that I could hear of. In the town of Mentz, about one and a half miles below Troopsville on the Owasco, is a quarry belonging to Mr. N. Marble, of Port Byron. It belongs to the upper range, and this is the last excavation for gypsum before reaching the quarries at Cayuga bridge.

Gypsum is abundant at Cayuga bridge; but one quarry worked, that of Mr. Williard. Mr. Titus has opened a bed a little north of the road, but has not proceeded further.

The beds at the bridge all seem to belong to the upper mass; they are wanting in the hoppers, in the "vermicular rock," the want of arching in the layers above the plaster, and they are accompanied by a class of cavities which I have only observed in those masses which hold the highest geological position in the third deposit.

South of Cayuga bridge, and about two miles north of Union spring, and near the lake shore, are the five plaster quarries of Richardson, Partenheimer, Cresis, Howland and Yawger. There is another quarry to the east of all these, owned by Mr. Thompson. These quarries lie farther to the south than any known in the district, extending with the lower deposit found at Montezuma, along a north and south line of about thirteen miles. For quality they are superior to any in the deposit, the masses also are larger, yielding often from 300 to 1,000 tons. They have all been denuded, for they are surrounded and covered by the most modern, the third, or upper alluvial of Chittenango, presenting none of these terminal associates, if we except the mass in which it was originally deposited, whose layers occasionally cover portions of the plaster. The matrix of the gypsum is here blackish in colour, earthy in its aspect, often variegated, sometimes contains lamillar gypsum, and more rarely a little pure sulphur. This mass has the appearance of an impure gypsum, and is considered by the quarrymen to be an incipient plaster, requiring time alone to make it perfect.

Some of these quarries are a few feet below the lake. They furnish about 10,000 tons yearly; delivered at the head of the lake from $1.50 to $2 per ton.

Richardson's quarry is the first quarry met with going south. It presents a face of about 100 or more feet in length, and from 18 to 20 thick. It is in solid, though not continuous layers, apparently horizontal. The surface is uneven, as usual with all the plaster masses, compact, of a dark colour resembling a variegated marble. In the fissures of the upper part, and sometimes in its interior, particles of sulphur from the size of a pea to an inch are said to be found, also small globular masses of white granular gypsum, which is taken for sand. On the top of the plaster, in parts, there is the mass before mentioned, which is considered to be the commencement of a new crop. The whole is covered by 8 or 10 feet of modern alluvial. The bottom of the quarry is a dark slate, or slate with nodules of plaster, resembling those of the upper quarries near Chittenango, and on the road to Jamesville. This floor was bored to the depth of 24 feet, all which was said to be in plaster.

The largest mass of plaster is at Yawger's, presenting a continuous face for several hundred feet, and from 15 to 25 feet thick. Mr. Yawger stated that plaster had been used there since 1811, without diminution of its good quality; a bushel of plaster yielded in produce what was equal to the cost of a ton.

In the examination of nearly every quarry in the three counties, these were the facts observed. The lower range of "plaster beds" are enclosed in a dark coloured, and to appearance, a somewhat altered mass, in which I was informed that Dr. Beck had found 20 per cent of magnesia in an analysis made from that of the Nine Mile creek. Resting upon this mass is the series which contain the hopper cavities, noticed by Mr. Conrad, and Dr. Beck particularly. Also the porous or "vermicular rock," and the organic remains. These latter I could only find in one position and in two localities. The porous rock seems to be disposed in two different ways. In one forming a bed, holding a position more or less fixed, and apparently extending over a large portion of the gypseous region. In the other, the masses are limited in extent, without fixed positions, appearing to have been deposited at irregular intervals.

The cavities of these porous rocks have no analogy whatever with those derived from organic remains, nor are they referrable to any porous rocks other than those of volcanic origin, and I should suppose that, were they not composed of carbonate of lime chiefly, but of the usual siliceous and argillaceous materials, the igneous origin would have been given to them by their first describer.

The common opinion that the plaster is still growing, is set at naught by the fact, that it is as fully formed where alluvial soil covers its masses, as it is where layer on layer of its own deposit is heaped upon it. No difference can be perceived in either. No increase, I should suppose, could have taken place since that period when it rose from the deep, to which it had been depressed by the masses which originally were deposited upon it, and which subsequently have been swept away.

The arching over the gypsum is readily explained from the facts which experience with "water limes" have given to us; and a fact noticed in a quarry of water lime, south of Chittenango, verifies that experience. That certain materials or mixtures will harden or sett, when others will be soft and yielding, may be considered fully established by the many experiments made with good and bad water limes, and by substances taken for such, and likewise that there is a difference in the time of setting of the different kinds. This is admirably shown in a layer of water lime back of Chittenango. The layer was about eight inches in thickness. The note I made was this: "Some parts of a course of water lime show a local disturbance, by which it is evident that a derangement can go on which extends but to a little distance from the action, and show that the parts disturbed were the first to aggregate." Within the layer of 8 inches, are two others more compact, of about an inch thick. These have been broken in many places, so that the parts no longer hold their original parallels, the enveloping part showing but few signs of disturbance.

In the material which covers the gypsum of the upper range, the arching is but perceptible, owing to its soft nature, whilst in the lower range the arching is common, and formed of harder, fine grained and a compact material. A considerable portion of all the arches resemble in fracture the material of which the porous rock is composed. These facts show that a hardening or consolidation of the matter of the arching took place before the gypsum wholly separated from the mass in which it must have been diffused, or, in other words, before it acquired the form in which we find it. On the contrary, where the arching does not exist, the particles which compose it, when pressed upon by the forming plaster, would have retired to the place of the least resistance, as is instanced in the material which encloses the two thin layers in the eight inch bed of the water lime of Chittenango.

There are two localities in which the porous rock is found in greater thickness than elsewhere met with, and merit examination from the connection with the immediate salt region.

The one is on the road from Amboy and Bellisle to the turnpike, a few miles west of Syracuse, immediately back of the tavern, and in the rise to the top of the hill. The other is on the Footsheet road, ascending from Syracuse to Mr. Jeptha Colvins.

At the first locality, towards the bottom of the hill, there are about twenty feet of these dark porous layers, and of configurations frequently met with elsewhere, probably belonging wholly to common salt or else to sulphate of lime, not having yet determined. To these others succeed, and then those with vertical fissures, with a few small thin shelled bivalves, similar to those of Bull's quarry, also a few small fucoides. The terminal mass is the " vermicular rock," from four to five feet thick.

The locality near Syracuse is of greater interest, for besides the two porous masses of the hill to the west, there exist at no great distance below the upper porous rock, a series of highly crystalline aggregates, wholly different from every product yet met with in the Third District, if we except the dykes noticed in the last report, and a few thin ones yet to be mentioned, which are found near Ludlowville, above half a mile east of the village. The description of these crystalline rocks, should time admit, will be given as an appendix to the report. For the present we add the note which was made in passing up to the top of the hill. The first product met with is the gravel of the second alluvial. This is followed by the red earth, and which always forms the third or upper alluvial. Beyond these, in rising, is the drab coloured slaty rock, the first seen. The next resembles the usual envelope of the lower plaster. To this about 20 feet of layers, with small pores, succeeds, and then an interval from depth of soil for some distance takes place, and then again the rock masses which compose the upper part of the hill. The first is a marly shale. Then mixtures with more carbonate of lime, some compact, some crystalline, confused, aggregated, and presenting cavities lined with crystals of that mineral, and containing also sulphate of strontian in the mass and in the cavities. With these and above these, are other aggregates like serpentine, marble, &c. with purplish shale, or slate which are followed by a green and blackish trap-like rock, as to appearance, but too soft for that rock. After this, that is above it, is the mass which resembles the material which forms the arch of the lower beds of plaster, and this is covered by the upper porous or " vermicular rock."

Magnesian Deposit.

This deposit terminates the group. It appears to be a thick series of what is probably a magnesian limestone. Usual colour is of a brownish drab, and also dove, breaking with rather an earthy fracture. Its great characteristic, and which will suffice for the present report, is its fibrous cavities, caused by the crystallization of sulphate of magnesia, as we fully proved in the last report. These cavities are very numerous in the series, and in every locality where they are found show that they follow the gypseous masses. The most numerous are found at Hungerford's plaster quarry, and also by the rail-road just below Split rock quarry, near Syracuse. Likewise near the upper plaster quarries, on Cayuga lake, the mill at Troopsville, &c. &c.

The cavities in this series are more frequently found in a vertical position, like veins, than in an horizontal one, as is usually the case. The cause seems to be, the existence of imperceptible cracks, by which water has had access to the rock, and the salt has crystallized in accordance with the direction taken by this fluid. This opinion is confirmed by the facility which the rock breaks with more or less even surface in the vertical direction, and by toughness and unevenness in the horizontal one. The cavities strongly contrast with the rock, from thin lining of coaly matter.

Salt Wells or Borings of Onondaga.

The borings and wells which have been made at Syracuse, Salina, Liverpool, Geddes, Montezuma, &c. prove that the brine or salt waters exist in all these places in geological materials, which serve as reservoirs; they were not the materials which contained or enveloped the saline particles or masses from whence the waters obtained the salts which they held in solution, and which give to them their briny character. These reservoirs are of two kinds. The one formed of the porous or loosely aggregated materials, which form the second deposit of the group, and the upper portions of the red shale. The other being excavations, once forming the deep bottoms of ancient valleys, now more or less and irregularly filled with alluvial materials. These two classes of reservoirs, in all probability, when not remote from each other, more or less communicate together. At present but one of the latter class is known, and now forms the bottom of Onondaga lake, but similar ones no doubt will be discovered, caused by the many large bodies of water which at a former period flowed from the south, but which now are concealed by alluvial materials.

If the opinion just given be true, we ought to find two distinct classes of borings, one referrable to the rock layers which form the geology of the county, the other to no part of the saliferous group, nor of any rock mass of the Third District, but to its alluvial materials only. These borings also establish other important facts, to which we shall advert in their proper place. It is greatly to be regretted that no minutes of the borings were made and specimens saved, all the information collected being chiefly verbal, and obtained from Dr. Wright, the superintendent of the Salines.

At Liverpool, north of Salina, there are two borings, one immediately below the bank of red shale, upon which the town is built; the other some distance to the southwest, on the outside of the canal, and opposite to a depression which is in the direction of a supposed outlet to Oneida lake. This well is 81 feet deep, water good, if not as good as any on the salt reservation. Less water is drawn from this well than from the one at Salina. This well was bored through about 12 feet, principally of lake marl, below which was 14 feet of fine sand, followed by 43 feet of a very fine clay of a grayish colour, under which, to the bottom of the boring or well, as it is termed, was gravel with some sand.* The first boring, the one below the bank of red shale, was 274 feet deep. Its whole course was in the red shale mass. At 60 feet there was fresh water, and below that point there was no salt water worthy of attention.

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* See Dr. Beck's Report.

At Salina, there are three wells or borings, all which are in the marsh, situated like the well at Liverpool, of 81 feet deep. The principal well is 72 feet deep. It passes through muck and lake marl, indurated clay and pebbles, thin coating of gravel, sand and gravel. Its source is in gravel. This is the well which furnishes the greater part of the water used at the salt works. Its supply is most copious.

A well, beyond or nearer to the lake, gave 6 feet of muck, and from 5 to 6 feet of lake marl, which is the usual thickness of these two deposits; then marly clay, of about the consistence of soft butter, for 30 feet, black sand about 35 to 40 feet, clay and gravel 2 to 3 feet, coarse gravel, sand, &c. at the bottom, depth being 90 feet. The water of this well is strong, being 78 per cent even after being used for two or three days. The well at Syracuse is an old boring. Its depth is 160 feet. It passes through the usual muck and lake marl, then sand and gravel all the way. The water is what is called good. There is a natural defect in this well, which makes it less serviceable than the other wells. By pumping, its water soon becomes weaker, showing a ready admission of the upper waters to the well or part from whence the water rises into the pump tree. The supply to this well is so copious that the well often overflows, yielding at the surface a water of from 20° to 25° in strength. This well is about midway between parallel lines of the Geddes and Salina wells, and it is said that salt water can be traced along its parallel upon the surface of the marsh for some distance, either by a white saline crust in dry weather, or by the samphire plant.

There are two wells at Geddes, and according to Dr. Beck, one is 124 feet deep, the other 176 feet. I could get no other information of the strata through which these borings are made, than that they consisted of alterations of green, blue and red shale. The " veins" of salt water, appearing in soft or porous layers.

From these borings it is evident, that two kinds of materials are met with. The one appertaining to the group of the Onondaga salines; the other to the alluvial. In the one we find no pebbles, stones and sand, whilst that of the other is composed of like materials.

The occurrence of brine in two distinct classes of materials, so wholly discordant, geologically, from each other, show at once a common source from whence the saline materials were derived. That these materials were not derived from the alluvial is certain; that they were derived from the shales in which the borings were made, there is not one fact to prove.

The proof of saline waters, existing in alluvial materials, being established, and to the depth of 160 feet, as in the Syracuse well, we have now to show that such depressions did exist in this ancient area; for though the fact of the existence of alluvial at such depth is proof sufficient to those well acquainted with the subject, yet we know it is not to those to whom geology is yet a novelty. This proof exists, for we believe that there is no fact, to which a key is not to be found.

Lake Sodom.

This lake was examined by Dr. Wright, Dr. Beck, and myself. It is small, singular in all respects, and merits a better name. It is about one and a half miles east, of Manlius centre, and a few rods south of the canal, the waters of which are about five feet above those of the lake.

The lake is excavated in the second deposit, and in the red shale. Its sides and bottom are covered with lake marl. The trees that have fallen into it are whitened by it. The shore on all sides shelving to a depth of 20 feet at the distance of a few yards. The water is remarkably transparent, and of the greenish tint common to such waters. In proceeding up the outlet from the canal, which is narrow, and about a half a mile in length, you enter the main body of water, and by removing a short distance either side, so as to lose sight of the outlet, the lake then assumes the form of a circular pool as regular as if scooped by the hand of man. It has the appearance of having been caused by a whirlpool of great magnitude.

This lake was sounded in many places. The outlet gave from 25 to 80 feet of depth; and the pool, where the circle commenced, beginning near the outlet, gave from thence to the centre, from 104 to 168 feet in depth. The bottom was of blackish coloured marl, the lead sinking a foot or more into it. The water, near the bottom, we found to be highly charged with sulphuretted hydrogen, but contained no saline matter that was perceptible to the taste. There is another lake rather smaller which we did not visit which is connected with Sodom lake by a small outlet which is only visible when opposite to it. Sodom lake is 44 feet above the level of Onondaga lake. Its depth to the marl, at its bottom 168 feet; leaves 124 feet. What the thickness of marl is, cannot be conjectured; but this depth proves the existence of a deep depression below the surface of the area, and in the lower part of the saliferous group of Onondaga. When we consider that Sodom lake is wholly unconnected with any of the present or ancient water courses, we should expect a less erosive action than where a connection with such existed.

Onondaga lake is but the extension of the vally which lies south, and the Onondaga valley, like every valley north, is connected with a valley which lies south, and reciprocally every valley south has its northern valley, and whether you rise towards the point where the waters divide, either from the south or the north, you find that the sides of the valley lose but little of their elevation, thereby proving the existence of a more ancient valley, and anterior to the cause which formed the double plane which they present. This view is given to show that great and mighty changes, but simply wrought, have taken place upon the elevations of the Third District, which should lessen our surprise for changes of a like kind upon a depression; when a cause of erosion existed upon those heights; one of which outlets was by Onondaga lake.

Looking over the surface of Onondaga lake we find it encircled by a white margin, which when examined, shows that it is formed of lake marl, the part exposed to the air being in a state of aggregation, which gives it the appearance of tufa, but in gravel-like fragments. With the exception of the hills at Geddes, Salina and Liverpool, the margin of the lake lies very little below the general surface of the country.—These hills show by their composition that they are the remains of the ancient sides of the valley, being formed of the masses which belong to the saliferous group.

The proof being ample, of the existence of a deep excavation where Onondaga lake is seated, and the same excavation being filled, in part, with alluvial materials containing salt water, nothing more is required for a right understanding of this reservoir, than an impermeable covering to prevent the union of the salt water of the alluvial with the fresh water of the lake. The salt water often rising in its reservoir and flowing over its limits to the lake. This covering is the lake marl; it is coextensive with the whole border of the lake, extending inwards until lost to the eye, but met with in every sounding that was made, only sullied by vegetable or argillaceous matter in the deeper parts of the lake. In all the borings for salt water this marl is constantly traversed, unless the boring is in the original mass or rock. Its thickness is about six feet, and highly adhesive or tenacious in its character. No material for insulation could be better, and seems to me to fully explain the separation of the saline waters which it covers, from the waters of the lake, to which it forms the bottom of the basin.

In order to ascertain the depth of the lake, the kind of water which exists at the bottom of the lake, and the nature of the bottom, Dr. Beck and myself made an excursion thereon. We found that the greatest depth was opposite to Liverpool, about midway between the west shore and that place; it was 65 feet. The water obtained from that depth was just as fresh or pure as at the surface. We found that the water gradually deepened from both sides of the lake, less gradually, however, on the western shore than the east shore. To about fifteen feet from either shore we found the marl was white, but beyond it was of an ash colour, and also blackish blue, the lead sinking into it for many inches. Where the waters from Nine Mile creek enter the lake, as we supposed, the water deepened from 10 feet on both sides to 25 and 28 feet in the inlet.

The boring which was commenced in the summer at Salina, by authority of the Lagislature, in the hope of obtaining rock salt, or a stronger brine than any yet discovered, is near its completion. It gives negative knowledge as to the object for which it was undertaken, but some valuable facts for the history of the salines of Onondaga. The facts are confirmatory of all that we have advanced. It was evident that rock salt could not be obtained where the boring was commenced, because it was at least 100 feet below the porous rocks and the position of the hopper cavities, the only position where salt, from observation, could be expected to exist. With respect to salt water, it was too near the line of the shore of the ancient excavation, to calculate that any great depth of alluvial could be obtained, and without which no greater strength of brine could be expected, unless the red shale deposit was in connection with the deepest alluvial, which the deep boring at Liverpool negatives.

At my last visit to Salina, the boring had attained 85 feet, 62 of which in small gravel with earth, large gravel with fragments of 2 or 3 inches diameter, more or less water worn, consisting of granite, hard gneiss, red and gray sandstone, black limestone and a piece or two of the porous rock The last 8 feet was what is called hard-pan, being clay and stones cemented, under which
at 62 feet, red shale yielding at
72 " small veins of salt water from a porous rock.
76 " bluish shale, forming a tenacious clay, in which the boring continued to
85 " when I left Salina. Since then I have received eleven spe-

cimens of the borings from Judge Allen, the inspector of the salines, and also the following account of the continuation of the boring. On the 13th Nov. the Judge writes, "We have drilled 435 feet. Temperature now 55°, (water) very little brackish."

"At about 260 feet from the surface we struck a red rock much of the colour and hardness of red chalk, and it has continued the same until now."

"At 88 to 98 feet below the surface the red shale had a singular appearance. A German who called there, and professed to be a mineralogist, told the workmen it contained mercury."

"At about 150 feet from the surface there is some substance which produces a curious effect on the drill poles. When first drawn up they look as though dipped in butter-milk; when exposed to the air they become encrusted with a red scale. About 60 feet of the rods are encrusted in this way."

The 28th December the Judge again writes: "We are now 531 feet, with little variation since I wrote you; in short, since about 270 feet the same red rock continues, with the exception now and then of a foot or two of green shale."

The specimens received from Judge Allen, arranged in the order of their distance from the surface, are as follows:

G, from 88 to 98 feet. This is in colour a brown fawn, particles almost impalpable to the touch. It is not likely to contain mercury, for there is no ore of that metal which resembles it, and mercury is found in a less ancient position, being of the age of the coal formation.

A, about 100 feet from the surface; 7 feet thick, of a blue ash colour, and slightly effervesces with an acid.

K, from 129 to 278 feet; three varieties, all slightly effervesce, one earthy and of a gray pearl; another in fragments of a similar colour, but in layers; the third kind in fragments; but with a reddish colour.

D, 290 feet; layer 3 feet thick, in fragments of blue or green shale, compact and hard.

E, 297 feet; 30 feet thick, hard dark brown red shale, with some grains of quartz sand.

F, 356 feet; soft red shale, no fragments, all paste, and very adhesive; the last four days cut 8 feet in 24 hours.

H, 364 feet; red shale, fine in its powder, very adhesive.

J, 370 feet; red shale, very adhesive, adhering to the drill in the shape of a plug.

M, 446 feet; red shale, same as above, to appearance. The progress of boring in this shale was 5 feet in 24 hours. These red shales appear to contain very little brine; in some, no perceptible effervescence.

In the same letter, there is an account of the boring of another well, which is as follows: "We began a well in October, near the present well in Syracuse, being about the middle of the valley, and in the margin of the creek.

"The first 8 feet clay and marl; then gravel cemented slightly together, to about 97 feet; from that depth to 115 feet, mostly sand, mixed with the same kind of gravel, and from thence the gravel has been coarser, and but little sand to the present bottom, being 136 feet.

"The gravel is blue limestone, red sandstone, white sandstone, some small pieces of blue shale, very few red, granite and hornblende rock.

"The greater part of the gravel is blue and black limestone pebbles, of an inch or two in diameter, and larger pieces of gray limestone, from one pound to four and five.

"The water is now 60°; we expect to go about 20 feet more, say 160 feet, and hope to get water at 64°."

This boring shows that it is in the alluvial of the excavation, whilst the first or deep boring passes through the same alluvial, and extends towards the bottom of the red shale. Should the red shale be near its termination, then the rocks of the protean group will be reached before the 600 feet of boring will be attained; a fact of no small importance to those who have no faith in geological principles, confidence ending where sight cannot reach.

One boring yet remains to be noticed, that of Major Byington. It was at the top of the hill which rises in Salina, and extends south, passing Syracuse to the east. The boring was near to the Sink Hole, described by Dr. Beck, and not far also from the road where the porous rock may be seen. The boring, with its well, which latter was first dug, were 370 feet deep. The first mass passed through was alluvial; this was 40 feet thick; then plaster rock 50 feet, after which the boring passed through alternations of greenish, bluish, and red shale layers; the order not remembered by the Major. The borings by drying in the sun, gave an effloresence of salt, but the discontinuance of the work proved that it afforded no encouragement to a further prosecution. The hill where the boring was made is 220 feet above the lake, consequently leaving 150 feet of excavation below the lake.

With an observation or two, we shall terminate all that we wish to say in this report of the brine reservoirs of Onondaga. From all the borings which have been made in the rock, if we except those of Geddes, it does not appear that they afforded any workable or profitable quantity of brine, and I am disposed from that circumstance to believe that such would be the case with the wells at Geddes, were they insulated from the alluvial.

Finally; theory, or in other words, conclusions from facts, prove that the deeper the wells are sunk into the alluvial, all other circumstances being the same, the stronger the water. As the deepest alluvial must be where the excavation was deepest, this point or place must be first determined when stronger brine shall be needed.

The whole of our observations show that we are not to seek for salt or the source of the brine where we now find its waters, but to seek it where it had existence, and where it has been recognized by all who have seen the hopper cavities and know their origin. They may be considered to be too few for so great a source as we have presented to us at Onondaga, but it does not follow because we see comparatively so few, that there are not localities where they were and are more numerous. Were it otherwise, we should vainly look for rock salt, since no trace of its existence in the district has met the eye of any one. Moreover, we must not lose sight of the porous or "vermicular rock," which is far more abundant than the hopper cavities. I do not for a moment suppose that the pores were formed by the salt, for we are without proof of the kind. I adopt the received opinion that they are caused by gaseous or vaporous matter, but I can readily conceive that on the removal of the elastic force that gives rise to the pores, the salt, in obedience to a common law of crystallization, would take to the cavities from offering no resistance. Besides, we must not overlook the fact, that though the cavities of all kinds in any one locality be not great, the deposit which extends south, east and west, is to a great extent subject to the drainage of a reservoir, known by the well at Syracuse, to be over 160 feet deep, and extending north and south to distances not known.

In this report, I do not assert that rock salt has no existence within the district, for no proof is known that it does not, or proof that it does. It is very certain that the surface of the hill between Salina and Syracuse exhibits proofs innumerable of the removal of a soluble mineral; the species remains yet to be determined. I did not examine the cavity which Dr. Beck describes, having left it for another period.

There are but three abundant minerals which are soluble in water, carbonate of lime, gypsum and common salt. Each of them produce sink holes, in consequence of this property. It is not at all impossible, that salt in abundance may have been deposited near the sink holes, for such is the position of the hopper cavities and the porous rock, all which long since have been removed from the permeable nature of the gypseous hills. This is the hill which crosses the Fort-street road, where dubious rocks were observed, and which I have no doubt owe their nature to a high grade of thermal, if not an igneous temperature.

The fact of the difficulty of obtaining water in the gypseous hills, unless by sinking to the level of the water courses, show that there is little probability of finding salt above the level of the waters, from having long since been dissolved; but below the water levels no such objection can exist, if we except such portions as the drainage to the ancient excavations may have removed. The place, then, to bore for salt is below the level of the waters, in that portion of the third deposit which contains the hopper cavities and porous rocks, which from the dip of the whole group, must be sought south, and not north of Syracuse.

Montezuma Brine Springs.

In the present report, we shall say but little of this saline, so many of our pages having been given to Onondaga, from the desire to contribute our mite towards making known its true history.

From the report of Dr. Beck, it would appear that the three wells or borings were all in the alluvial; the first about 100 feet in depth, the second 80, the third 121 feet. This latter, the new well to which the section given by Mr. Conrad, in his report of this district, belongs. By the section, it appears to have been sunk in 77 feet of alluvial and 44 of the lower gypseous or second deposit of the group, salt water having been found in connection with the whole of the strata. It was in the last five feet of the alluvial that a mass of granite of 500 pounds weight was discovered.

North of Montezuma, in the Cayuga marsh of Superior, now Howland's island, a boring was made in 1827 and '28, by Mr. Howland, for the purpose of finding brine, as salt had been manufactured in considerable quantity on the opposite side of the river, on lot 54, in Wayne county. The boring was about 20 rods from the upland, in the marsh or swamp. I am indebted to Mr. Howland for the detail.

First 5 feet muck; 6 feet marl, shells, white, pure; 4 feet clay, soft, blue, pure; 10 feet quicksand; 4 feet loose gravel; 11 feet sandstone, gray; 4 feet plaster, gray, mixed with white, some transparent; 20 feet dark stone, interspersed with white flint, sharp grit; 7 feet soft rock, interspersed with isinglass; 28 feet dark coloured stone, softer than the mass of 20 feet, but sharp grit; 25 feet blue, very soft rock, interspersed with white chalky substance, like salt or magnesia in appearance; 36 feet soft sandstone, red, or red rock interspersed with one-fourth white chalky substance; total depth was 167 feet.

There is no mention made of finding any salt water, but before reaching the 167 feet fresh water rose in the tube to the height of 3 feet above the level of the swamp.

The borings at Montezuma prove that for 80 feet, the brine is in the alluvial, which fact favors the existence of original alluvial excavations now appearing as swamps, marshes, and probably may even exist beneath the gravel hills of that section of the country.

The only person that I am aware of who has given an opinion of the saliferous group of Onondaga, which accords with the one I adopted, is Prof. Rafinesque. In his Atlantic Journal, vol. 1, p. 73, he places it amongst the salses, using the term which Spallanzani had applied "to the mud volcanoes of Italy which commonly threw out salt water at the same time." It is impossible, consistently with order, not to view the group as a whole; for though its parts are different, yet they are not separable without destroying a certain harmony or unity, which results from the union of its parts. Regarding it with the eye of a chemist, we find that its prominent characters have been derived from the law of substances separating in the inverse order of their solubility. That which is least soluble is the first to deposit; that which is most soluble, the last.

In the first or lowest deposit, the red shale, we have the red oxide of iron, the least soluble material which characterizes the group. In the second and third deposit, we have the gypsum, which is next in order as to difficulty of solution; between the two upper ranges of this substance, we find the common salt or its hopper cavities where obviously it should be; and lastly the sulphate of magnesia, the most soluble of the four products, appears only in the terminal deposit.

Those who wish to see a practical illustration of the order in which the characteristics of the group separate from each other, will find it on visiting the salt pans where evaporation is carried on by solar heat. There he will find that the first deposit is the red oxide of iron, the second the gypsum, the third the common salt in its form of hoppers, or reversed pyramids, composed of little cubes, and on enquiry he will learn that the magnesia salt remains in solution.

We would also recommend a visit to Mr. Green's salt pans at Salina, where the boiling of brine is carried on in close vessels. There will be seen many products as to form, which are occasionally met with in the New-York rocks, and to which I have ascribed a thermal origin, such as oolite varying from the finest to the largest as in pisolite; also concretions of other kinds, fragments formed of thin layers that have been broken up and cemented together like to those we find in portions of the lower layers of the "calciferous sandrock," and also in the concretionary limestone which forms the base of the saliferous group.

Water Lime.

The water lime group of Manlius, is the next series as to age; it rests upon the saliferous group, and in all cases where a regular denudation has taken place, it is only to be found south of the gypseous range, being the overlying mass. The group is exceedingly well characterized by its fossils, of which some are extremely numerous, and are found from the Hudson to Cayuga lake. With but one exception, the whole of the water lime which is burnt for cement in Madison, Onondaga and Cayuga, is from this group; and the greater part of the limestone which is converted into lime along the same range, is obtained from it.

With this group, all the drab or light yellowish coloured limestones so common, and which gives character to the group below it cease, and with it is the beginning of the usual kinds of blue, gray and black limestone, which exist so abundantly above, and whose range is so extensive east and west

The upper layers of the group are from 3 to 4 feet thick, sometimes subdivided into what are called courses. There are but two layers of water lime separated by bluish black limestone, which is generally disposed to separate into courses, whilst the layer of limestone which is above the upper water lime is broken up by lines of fracture, in all directions. This is the layer which is most commonly burnt for lime. In general, the upper layer of water lime requires less heat from being of a less dense nature than the lower layer.

From the eastern end of Madison county, extending east through the Third District, there is a series of limestone layers which are not found beyond that boundary to the west. These layers are characterized by the Pentamerus knightii, Euomphalus profundus, Delthyris pachyoptera, D. macrapleura, Apiocrinites, &c. &c. and have not been seen west of the falls of Oneida creek.

These layers are followed to the east by a series of argillaceous layers full of that singular marine plant, the fucoides canda galli.

The omission or absence of these two series to the west, causes the next series of layers to repose immediately upon the water lime group. This is the white sandstone noticed on the hill at the falls of Oriskany, and for the present may be called the Oriskany sandstone. This sandstone is well known to extend over many of the States, occupying, like all geological masses, a fixed position in the whole series, but is exceedingly variable as to thickness. According to the report of the State geologist of Pennsylvania, it is there 700 feet thick. At Oriskany falls. about 20 feet on the road from Elbridge to Skaneateles, it is over 30 feet. At the quarries near Auburn, it is from a few inches to about 2½ feet; and at Split-Rock, near Syracuse, it shows itself in some parts by a mere sprinkling of sand, observable on the bottom of the layer which covers it, and in other parts by a thickness of about six inches.

This sandstone is the rock of which the lock at Jordan, not Lyons, was constructed. It was quarried on the road from Skaneateles, which goes by the east side of the outlet towards Weedsport. The lower part of the sandstone abounds in fossil shells remarkable for their great size. Most of them, if not all, are found in the gray sparry crinoidal limestone, which rests immediately upon the sandstone, and so far as I have had time to attend to their examinations, seem to be confined to the two rocks.

About three-fourths of a mile to the northeast of Perryville, on the farm of Mr. Van Eps, from 100 to 200 tons of iron ore was quarried, but found too poor, or too hard to work. It consists of mixtures in very variable proportions of red oxide of iron, sand, coarse and fine, with other silicious matter. Some of the ore is oolitic, some almost compact and jaspery.

This iron and its sand is found immediately below two of the layers of limestone which forms the great terrace which extends through the three counties, and belongs in all probability to the period of those series which are wanting to the west. This is the last appearance of the red oxide of iron in the district, unless it should be discovered in the red sandstone and red shale of Otsego, which occur high in the upper series, approaching to those which are near to the age of the coal.

Gray sparry crinoidal limestone. This rock in Madison, Onondaga and Cayuga, rests upon the Oriskany sandstone, or in its absence, upon the water lime group. It is the limestone so extensively wrought near Syracuse, at Split-Rock and the quarries to the west, which adjoin to it, and of those to the east near the village of South Onondaga. It is the limestone which is worked at the prison at Auburn, back of the village of Chittenango also, and other localities of the three counties. This limestone extends throughout the Third District, with but few interruptions. It is readily known by its gray colour, its crystalline fracture, its numerous organic remains, so different as a group from those of the rock above, and those below; for though it contains many of the fossils which belong to the sandstone, it contains a considerable number which are its own.

The bottom layer of the limestone contains rolled stones at its lower part, more flat than globular. Some of the stones are like the hard sandstone found with the iron ore near Perryville; others compact, hard, of a dark chocolate colour, and containing some small cavities which, from the lamillar structure, appear to be filled with anhydrous gypsum.

The gray limestone is the rock of which the mason work of the enlarged Erie canal is to be constructed; and for toughness and durability as regards the action of atmospheric agents, it has not its equal in the district. Its only defect that I am aware of, is one not of grain, but of division on the large scale, caused by its association with a greenish, shaly matter, which was not equally deposited as to quantity, nor equally distributed, but deposited upon parallel surfaces, or what is more likely, separated so to form such surfaces, dividing the whole mass into layers without courses, and layers with courses of different thickness in different quarries, and in different parts of the same quarry. A selection, therefore, becomes necessary, for a block cut from a layer with courses, requires to be handled with care to prevent a separation of its parts, and if exposed to water and frost, the like result must sooner or later take place. It is obvious that such stones cannot be used to advantage where a durable structure is to be made, unless placed below the point where air and congelation have access; and none but single or unit masses ought to be used above that point, and of the greatest dimensions; weight being of far more importance in our climate towards making permanent works, than the best cement yet discovered.

This limestone is but a thin mass of from 8 to 12 feet in thickness.

Above the gray limestone there is a series of shelly rotten layers of impure limestone, probably caused by an increase of the shaly matter of the gray limestone, changing all the characters, chemical, mineral and fossil which belong to that rock. The total thickness of the layers is from 9 to 12 feet.

These layers in their turn are followed by another small series, consisting of limestone, usually black, compact and rather brittle, generally terminated by one or two layers, containing nodules of flint, the flint arranged in parallels. In some quarries there are no less than ten layers or ranges of flint. With a change in composition, there is a change in the fossils likewise, which is common to all the New-York rocks, and to rocks elsewhere; a change of material denoting a change of circumstances, which whilst they favor the increase of certain classes and species of organic beings, may be injurious to others. The layers below the flint, which I understand is the true "cornitiferous rock," of Prof. Eaton, and are extensively worked at the different quarries to the north of Auburn, where the whole series may be seen from the upper part of the water lime group, to the layers which contain the flint. The whole disposed in two or more terraces which extend east and curve west and south towards Springport. The thickness of the last series from 15 to 20 feet.

Seneca Limestone. This rests upon the layers of "cornitiferous," as may be seen at the falls of Oneida creek. This is the last connected series of the great limestone range; all the limestones which are found above the Seneca limestone, with the exception of the Tully limestone, occur in short, interrupted layers that are local, being subordinates of the slaty shale rocks which commence from the Seneca limestone. This limestone I did not see at Auburn; the alluvial and village covering the space between the cornitiferous and the black slaty shale or "pyritiferous slate."

The Seneca limestone, I first met with in Seneca county; it is there separate from all other masses of limestone, and could be confounded with no other; hence its name.

This limestone contains but few species of fossil shells, one of which I have only seen in this rock. Another, the Strophomena lineata, I do not remember to have met with in any rocks below, and is highly characteristic of this limestone; for though it is found in the shales, which are several hundred feet above it, yet it rarely occurs in any of the limestones; and in some localities of the Seneca, the individuals are so numerous as to present almost as much shell as stone.

We have now, in this report, and in the one of last year, noticed in brief the whole of the groups and rock masses, great and small, which occur geologically between the gneiss of Little-Falls and the upper layers of the great east and west limestone range of of New-York, and in the order in which they follow or rest upon each other—the order of their age. The thickness of the whole, taking the measure of each rock and group where its thickness is greatest, exceeds 2,000 feet. All the different groups, containing organic remains, are readily identified by them, causing no difficulty to those acquainted with the fossils in assigning each group, rock or specimen containing them, to the place which it holds in the series.

Of the rocks to be noticed, there remains from 12 to 1500 feet before completing the whole of the series of the Third District. All which are anterior in origin to the coal. We had intended to have given the different groups into which this great mass is divided, from observations made with Mr. Hall, along the line of Cayuga lake to Pennsylvania: but the length to which this report extends, leaves but a few pages for the products which belong to the northern section of the counties, and therefore must be left for the subsequent one.

The Seneca limestone, in many of its localities, is of so dark a colour from carbonaceous matter as to be almost black, which is the case with the mass below it, but not in so great a degree. So great is the quantity of carbonaceous or coaly matter which colours the slaty shale, or the "pyritiferous slate" which rests upon the Seneca limestone, that it often exhibits itself as coal, giving rise to an expectation of discovering beds of workable or profitable coal, where such perceptible accumulations exist. A number of localities where excavations for coal had been made in this rock to the east of Oneida creek, were given in the last report, and a number of like excavations are to be seen in the same rock, to the west of that creek.

In many places carbonate of lime has been deposited with the material of the slaty shale, but not in sufficient quantity, excepting in one instance, to form a layer or two which extends for some miles. It generally forms those kind of interrupted beds which may be termed concretions, though they are of considerable length as to thickness. It also appears as septaria, but without divisions, or septa; and again, as perfect septaria, as at Auburn, in the outlet of Owasco lake.

Above the falls, on Oneida creek, just below the saw mill, two excavations were made for coal; one by a company, the other by Elias Mason; small pieces were obtained, but nothing which could give the least encouragement to those acquainted with the rock.

A boring of 100 feet for coal was made in the same rock, by Mr. Sage, near the road which goes from Chittenango to Cazenovia: And two excavations were made for the same object near Manlius square; one on the farm of Mr. Nettleton, near the turnpike, about a mile west of the village; the other a little further west, on Mr. Marsh's farm. The excavation made by Mr. Nettleton, is by the side of a brook, and in the black slate which is much contorted, owing to crystalline limestone which is mixed with it. Both are very black from coaly matter, of which minute veins are to be seen. At the place where coal was sought for, there is a fault, the first I met with going west. The waters of the brook flow over layers of limestone, which belong to groups below the slate worked for coal; the two rocks now appearing as parallel masses, and not as they were originally formed. A similar fault likewise occurs at Marcellus, where the slate is deeply coloured with coaly matter, and contains minute plants and fragments of the same. The cause of the fault is very obvious, at Marcellus; for the existence of sinkholes and the abundance of water from springs in the Nine Mile creek below, show subterranean passages or excavations by which portions or blocks of upper masses have been let down to a lower level. The same effect exists in the quarries south of Springport on Cayuga lake, where several extensive masses of two distinct eras may be seen, now nearly on the same level, having, no doubt had their foundations removed by springs or waters passing under them, similar to those of the village.

Tully Limestone.

After rising and entering upon the slaty shale and sandstone which cover the whole of Western New-York, to the south and east and west of the great range of limestone of which the Seneca is the upper part, we find but one extensive regular deposit of limestone, which from the town of Fabius, extends west beyond Seneca lake. The geographical distribution of this limestone gives to it a somewhat anomalous character, for it forms two ranges, owing to an enormous curvature or swell which this rock and its associates present, causing it, after it has dipped below the surface of Cayuga lake near the line of Tompkins county, to again appear and to rise nearly to the height of 100 feet above the lake, and finally disappear near Bloom's lime kiln, about five miles north of Ithaca. This is the Tully limestone, a mass from 12 to 16 feet thick, of a bluish and brownish colour, not remarkable for purity; making, as is said, a good, but not a white lime. It is met with at Tully Corners, at Borodino, on both sides of Skaneateles lake, on the road from Owasco to Kellogsville, at Martville, and the falls of Dry creek, below Moravia, and in the ravines along Cayuga lake, from four to five miles south of Aurora to Bloom's lime kiln.

Large angular masses of this limestone have been carried as far as eight miles south of Ithaca, or twelve miles from their original location. There is a mass at that distance on the farm of Mr. Hollister, which from its size was considered to be in its original place. It is quarried and burnt for lime. Other masses, but not so large, but sufficient for filling three kilns have been found five miles south of Ithaca, on the farm of Mr. Ludlow, and in other parts to the south, east and west of the same village.

The Tully limestone is the last mass of limestone that has been discovered south; all the carbonate of lime which occurs above it, is much intermixed with shale or sandstone, and with carbonates of iron and manganese; these two minerals seem to increase as the age of the rock diminishes. It is their presence that destroy, in all probability, the whiteness of the lime made from the Tully limestone, as minute veins of carbonate of iron are often seen in the stone.

Tufa and Lake Marl.

These two products are the same in composition, differing merely as to cohesion. One being formed under circumstances which admitted of cohesion or aggregation of its particles, the other being deposited in water like a precipitate, that fluid preventing adhesion.

Calcareous tufa abounds throughout the whole of the gypseous hills, the earthy limestones which they contain highly favoring the solvent powers of the water which percolates the hills. So also the great calcareous range contributes its portion, and the ancient alluvions likewise, some of which are highly calcareous, and have been carried south for a great distance, and affording a copious supply of the same mineral. The great abundance of calcareous waters in a zone or belt of about twenty or thirty miles wide, in the Third District, must exert no small influence upon vegetation, tending to give a kind of perpetuity to wheat, which, when such waters do not exist, that grain soon ceases to repay its cultivator, unless art makes up the deficiency.

An immense deposit of tufa covers the side of the hill and the road going from Tully Corners to Syracuse, on the west side of the Onondaga valley. It must be of great thickness, for neither the road which is cut into it, nor two ravines which are excavated in the tufa, reach the bottom. Lower down the same valley, at about fourteen miles south of Syracuse, there is another deposit, but of limited extent in comparison with the former one. It projects from the hill to the right on the land of Joseph Ackels.

There is a great deposit of tufa by the side of the rail-road which goes to Split-Rock quarry. It covers the side of the gypseous hill like a shield, the layers curving with the irregularity of the surface upon which it was deposited, and often discoloured or black by vegetable matter.

Chittenango has been celebrated for its petrified wood, or rotten wood replaced by calcareous tufa, which latter is very abundant, and covers the lower part of the hill-side just below the rail-road commenced by the late J. B. Yates. Very little of the petrified tree now remains; what is now to be seen resembles the thin irregular layers which are not uncommon to tufa. Other masses, without any defined structure, strew the side of the hill, a constant increase taking place, from the water which oozes out of the hill.

The space to the south side of Canastota, near to the village, comprising the low ground between the hills to the south and the rise to the canal, seems to be covered entirely by lake marl and tufa.

The depression in which occur the mineral springs of Messina, three miles east by north of Salina, is underlaid by tufa. It is well here to mention, that since Dr. Beck visited the springs a more copious one has been discovered, yielding, according to its proprietor, ten times more water than the former one.

Tufa is extremely abundant between Camillus and Canton, and between Canton and Elbridge.

One mile south of Peru, at the foot of the hill in the road, it occurs in great abundance It is the gravelly kind.

On Limestone creek, about three-fourths of a mile north of the Fabius and De Ruyter road, is a fine deposit of tufa, in the state of earth, and in porous masses, the horsebone limestone. The earthy part is made into bricks and burnt for lime. No lime can be whiter or purer than this is, and from what I could acquire, the lime is highly valued. The owner of the lime kiln informed me, that one bushel of *brick-lime* requires four bushels sand; one bushel of lime from the porous mass requires three bushels sand, whilst one bushel stone lime only requires two of sand. The deposite on Limestone creek extends up the hill for about 100 feet, and extends several hundred feet horizontally; thickness not known.

These are some of the prominent localities of tufa, whose value can not be appreciated in a region where limestone is so abundant, and where the natural soil amply enriches the cultivator, without the aid of art.

Lake Marl.

If the quantity of tufa be great, that of lake marl is prodigiously so, being found in nearly all the swamps, marshes, ponds and lakes which exist along the course of Seneca river and the Erie canal, extending from Cayuga marshes to Oneida creek. We mentioned that the whole of the bottom of Lake Onondaga was covered with marl, which extends along the head and foot of the lake to distances not ascertained, with a thickness of six feet.

The Cowassalon swamp presents the greatest accumulation of marl in the three counties. This swamp contains about 10,000 acres, 8,600 of which are land, and 1,400 are covered with water. Less water exists in this swamp than formerly, being connected directly with Oneida lake by a ditch of 14 feet deep, which was made at the expense of the state.

It is said that when the waters first flowed off by the opening of the ditch, it carried with them the muck which covered the marl, leaving a snow white surface of marl, co-extensive with the whole area which was drained. Imperfect attempts have been made with poles to ascertain the thickness of the marl, but without effect, no bottom could be reached. The ponds or marshes west of the swamp, called the Green ponds, have also bottoms of marl; so likewise has the Vlie or natural meadow to the south of the swamp.

The great swamp of Onondaga is the prolongation of the Cowassalon, and like it, is of marl also. Innumerable are the minor localities met with in going along the Erie canal towards the west boundary of the District.

Lake marl is likewise found in many places upon the great elevation, In the lake-like depression north of Peterboro', after crossing over a low stony ridge on the road to Perryville, the road traverses a level swampy bottom, the ditches for drainage being dug in lake marl. The lakes to the southwest of Tully corners are all marl lakes; so likewise are the ponds above Hamilton village, which serve as feeders to the Chenango canal, and likewise other small ponds in the south part of Onondaga and Madison counties.

Tufaceous Iron.

On the land of Robert Riddle, one mile west from Chittenango, I was informed that there was a deposit of iron, portions of which had been carried over Oneida lake, but the owner of the ore received no encouragement from the owner of the furnace. I found it to be a calcareous tufa, stained with hydrate of iron, and noticed that the spring whose water deposited the tufa, gave no signs of iron, but that the ore came from the sluggish water of the boggy soil above the tufa. In some of the masses of ferruginous tufa there was a coating of oxide of manganese.

The same kind of tufa, stained with oxide of iron, is found on the land of William Wheeler, about two and a half miles northeast of Salina. For a few hundred yards on a slope to a swamp north, there is a deposit of tufa, the upper part of which is in some places deeply stained with oxide of iron. As the deposition of the tufa is constantly going on, the soil, which is composed of muck chiefly, rises. It is from the soil that the iron is derived, as mentioned in the first report of the Fourth District. That the iron is furnished from the soil, is evident from the fact, that the lower part of the tufa is not stained with iron, and that a spring which formerly deposited iron, when its waters were in connection with those which flowed from the soil, now deposits none, its waters being separated from those derived from the soil. It is rare to find tufa, or lake marl, not covered with black vegetable matter, or muck, and there are many similar deposits of this kind of ore in the Third District, north of the gypseous hills.

This ore is not in sufficient quantity to be an object of utility, especially as all the red oxide of the district, the only abundant ore, is too calcareous for a like mixture; but were the argillaceous ores abundant, the tufaceous ore then would be of value, furnishing not only a flux but metal also.

Another locality of the tufaceous ore is on Nine Mile creek, between Marcellus and the great *embankment of the Syracuse* and Auburn railroad.

Clays abound in the Third District, usually in low situations, being the deposit of tranquil waters, whilst sand, gravel and other products of alluvions are thrown into hills and ridges.

The clays are either of a lead or of a yellow colour, well suited for bricks and the coarser kinds of pottery, though there are some, if not too calcareous, which may answer for finer kinds. Either there is but little iron in the clays of the Third District, or the quantity of carbonaceous matter destroys the red colour of the iron, the bricks in general being of a light, and not of a full red colour. Clays are exceedingly abundant in the low grounds north of the Erie canal, and in the southern parts of Cayuga, Onondaga and Madison.

Alluvions.

Besides the clay deposits of the low grounds, &c. there are three other depositions of alluvion as to age and composition. They are but seen in the hills, and to more advantage in the village of Chittenango than elsewhere. The lowest mass is a light coloured sand, in parts indurated, and in layers, with a slight inclination to the north, as though the sand had been thrown up from that direction. The upper surface has been furrowed before the deposition of the next mass, which consists of rolled stones, black sand, &c. The stones are gray and red sandstone, limestone and pebbles of primary rock, none of them present the flat disk-like form common to the stones of the shores of Lake Erie and Ontario, and from that fact it would seem that the waters which caused their form, were different from those of a lake beach, or that the duration of action was not so great. In one place the layers of this second deposit have been arranged under peculiar circumstances. The sand which forms its base has been worn so as to present an angular elevation, upon which or against, the pebbles and sand of the second mass, to a certain height, are arranged in layers parallel to the two sides, but above that height, though the pebbles of the upper part continue to be parallel to one of the sides, it is an angle with the other side. A fact of some importance in practical geology, where rocks of the same composition are not parallel to each other.

The upper surface of the second mass was likewise furrowed, or made uneven before the deposition of the upper or third alluvion. This contains the red earth from the destruction of the red shale, with rolled stones, great and small, and often to be observed from ten to twenty miles south of where we now find it in situ.

Minerals.

Besides those which have been mentioned in the body of this report, there are few others to be found, and those only in small quantities.—Fluate of lime, in the gray sparry limestone, at the quarry of the New-York company at Auburn.

The same mineral was likewise found in the water lime series just below the above limestone, on the road from Cayuga bridge to Auburn. Sulphuret of lead from near Hamilton village.

Sulphate of strontian, in the septaria of the black shaly slate above the Seneca limestone, and in a similar slate above the Tully limestone, from many localities.

Petroleum.—This Mr. Hall and myself saw in the septaria above the Tully limestone, near Ogden's ferry on Cayuga lake. It was accompanied, likewise, by a liquid substance of the colour of phosphate of iron, or Prussian blue, and by another substance like spermaceti before the oil is fully pressed out of it. It was composed of fine scales, had a yellowish white colour, was in small irregular masses, with the appearance of having been melted. Both of these two last substances are new.

Serpentine of Syracuse.

The green and trap like rocks observed near the top of the hill to the east of Syracuse, have been examined so far as time would admit.—They are all serpentines, more or less impure, and of various shades, of bottle green, black, gray, &c. They all produce sulphate of magnesia by oil of vitriol. These serpentines are at least new varieties for our country. Some have a peculiar appearance, like bronze, owing to small gold-like particles, with a lamillar structure, resembling bronzite or diallage metalloide. Also, other particles highly translucent, like precious serpentine, with frequently small nuclei resembling devitrifications or porcelanites, coloured white, yellow, blood red, variegated, &c. The grain of this kind is like common serpentine. In other kinds, the mass seems to be made of small globuliform concretions, varying in size, being centres of aggregation; some are of dark vitrious and serpentine, others of the compact kind, the enveloping part of a light colour. The first impression of this rock is like some of the New-Jersey trap-rocks, where amphibole is in imperfect crystals, or like a pyroxenic lava, with its imperfect crystals imbedded in the more compact material.

These two principal varieties produce endless mixtures upon the small scale, to say nothing of those derived from difference of shades of colour, the presence of veins and mixtures with the associated shales.

These serpentines seem to resemble the ophiolites of Tuscany and Florence, and should the views of Brocchi be correct, they may not only be similar in origin but in age. The objections which Mr. Brongniart makes to the very modern characters which their associates present, are all in perfect accordance with those of the New-York rocks, and no one acquainted with the facts which the survey has made known, at all doubts that those rocks belong to the period, or age, intermediate to the crystalline or primary rocks, and the coal of Pennsylvania; in other words, to the transition class.

Of the specimens collected during the survey of 1838, there are sixteen boxes in the rooms of the Third and Fourth Districts, at the State House.

I had intended to have given a list of the fossils which have been found in each rock and group, but circumstances render it proper to defer the same to the next report.

Since concluding my report I have again had the pleasure of hearing from Judge Allen, giving the progress made in boring since the 28th December. At that period the depth was 531 feet, and in red shale. Since then the boring has attained to the depth of 550 feet, being an advance of 19 feet. Within the depth of 536 feet it was thought that about one foot of light coloured sandstone, very hard, had been drilled, and followed at 536 feet by what was called blue limestone. The Judge writes, " It probably is that. It is very hard; we bore only about 18 inches in 24 hours. The rods are indigo blue when drawn up; after standing some time they turn brown, or colour of iron rust."

"We are now 550, and in the same blue or black limestone. When we struck limestone, water from the bottom of the well was, say 50°, and is about the same now, not more; the water, which runs away quickly from the surface, at the mouth of the well, is 20°. My own opinion is, there is no salt water in the shaft, except what descends from the gravel beds above, and through the fissures and seams in the rocks, and they are frequent, and occur in the present lime strata."

This information makes it certain that the red shale mass has been penetrated, first meeting with a thin sandstone bed, and then finally the dark blue shales and the black limestone of the protean group. In every locality east, where the connecting rocks can be seen, the limestone is followed and preceded by blue shale. This fact is evident in the ravine back of Dr. Noyes' house, near the college in Clinton, also on the road from Clinton to Waterville at Hart's mill, and on the creek by Rogers' machine factory, which empties into the Sauquoit. The "iron rust" of the borings in the limestone can be seen in many of its localities. At the quarry back of what is called Turkey-street on the Skanandea, also in the road to the northwest of Skanandea village, and in most of the quarries of Onondaga and Cayuga, where the concretionary rock exists, for in altering by exposure to the air, it seems to contain iron and manganese, which is the cause of its brown rust.

Between the blue shale above the limestone, there is a bed of green shale; this may have run out at Salina, or have been replaced by the sandstone met with, or not noticed; as Judge Allen observed in his letter, that at the depth of near 600 feet there is great difficulty in determining changes, unless well marked difference of character existed, and for obvious reasons.

LARDNER VANUXEM, *State Geologist.*

THIRD ANNUAL REPORT

Of the fourth Geological District of the State of New-York, by James Hall.

To His Excellency William H. Seward,
Governor of the State of New-York.

SIR:—

Conformably with a commission received under the law authorizing a Geological Survey of the State, I have the honor to submit the following report of the progress of the survey in the district assigned me.

During the past season, the examinations in the Fourth Geological District have been principally directed to the counties of Seneca, Ontario, Yates, Tompkins and Chemung. Some cursory observations were made in the county of Steuben; and a re-examination of some parts of Wayne, with a view to ascertain the true position and extent of the iron ore, as well as to determine whether it be confined to a single bed or stratum, as heretofore supposed. The iron ore of Wayne county is of more economical importance than any other object, the gypsum excepted, in this part of the State; and I considered it necessary to devote some time to this subject.

Examinations in that part of the Fourth District which embraces the southern range of counties, can be profitably pursued only during a short period of the summer months. It becomes necessary therefore to divide our labors between these and the more northern and cultivated counties, instead of exploring throughout its whole extent each individual group or series of rocks. This would certainly be preferable, since the rocks are of variable character, and some essentially change or entirely disappear farther west; and from the limited portion examined, we are prepared to find very great differences in the fossil contents of groups at distant points. Such a course however could not be obviated, unless more time were allowed for explorations in the unsettled portions of this district.

In company with my colleague, Mr. Vanuxem, I passed several weeks in examinations along the boundary line between the Third and Fourth Districts. The admirable facilities afforded by the banks of Cayuga lake, the valleys south and the ravines north, have enabled us satisfactorily to determine the succession and character of the rocks from Lake Ontario to the Pennsylvania line. Hereafter we shall be enabled to avoid collision and discrepancy in our descriptions, and to designate groups without confounding them with each other. We have also found the solution of many difficulties, in part arising from previous partial examinations, and also from the fact that the character of several rocks below the Onondaga limestone entirely or materially change in their eastern prolongation; and more especially after passing the longitude of Cayuga lake.

In Wayne county, on either side of the outlets of Cayuga and Seneca lakes, the rocks are frequently covered with high alluvial hills, thus almost precluding accurate examination; and in some of the softer rocks, which have been worn down by the same alluvial action, the concealment is so complete as to leave us in entire ignorance of the underlying strata. In the neighborhood of the Canandaigua outlet the country is covered in the same manner; and the rocks are visible only where streams of recent origin have found a passage. Thus the examination of such regions is rendered laborious, and accuracy can be attained only by minute and multiplied observations, by continued investigation and an extended knowledge of different localities.

With regard to the arrangement and succession of rocks presented in the section accompanying the report of last year, I have no important alterations to suggest. The names applied to the rocks were nearly all those which had before been used, or such as were merely descriptive, and intended to remain only till further research and concert of action should establish a nomenclature. This to some extent has already been done; and thus far we will point out the changes to be made, and the names to be permanently applied.

Every one who has studied rocks even partially, is aware of the insufficiency of mineral or lithological characters for giving nomenclature, and the many errors into which he may be led, whether in his own researches or by the mistakes of others. So likewise in the present state of our knowledge, we are unable in all cases to give names from fossil characters; for though without doubt every group embraces its peculiar fossils, yet in all localities these may not be so marked as to excite attention, and in some may possibly be absent. It thus becomes a desideratum to distinguish rocks by names which cannot be traduced, and which, when the attendant circumstances are fully understood, will never prove fallacious. The basis of this nomenclature is derived from localities; and the rock or group will receive its name from the place where it is best developed. For example, the rock denominated in the section calcareous shale, simply to distinguish it from the green argillaceous shales below, will be called Rochester shale. In lithological characters it is extremely like one far higher in the series, but the fossil contents are entirely different. This contains the Asaphus caudatus, Trimerus delphinocephalus, Platynotus Boltoni, besides species of Orthis and Delthyris, all peculiar to this rock, and the characters if studied and well understood at Rochester, will guide the observer in all subsequent examinations. The limestone at Lockport excavated for the passage of the canal, we propose to call Lockport limestone. At this place the rock possesses in an eminent degree the geodiferous character, which has hitherto given it its name; but this is quite inapplicable to the same rock where seen in Wayne county. Yet it is believed that if thoroughly examined in all its varieties at Lockport, it will not be mistaken even in its eastern prolongation where it becomes a dark, nearly black, compact limestone. At some intermediate points, as Rochester, the rock exhibits an intermediate character, and at such places it can be advantageously studied. The rocks just named, together with the green shale and iron ore, the upper member of the series being the Lockport limestone, belong to a group very appropriately termed by Mr. Vaunxem, Protean. To this belongs a rock which has been designated by its contained fossils. Associated with the green shale and iron ore is a mass of limestone characterized, as Mr. Conrad observes, by broken shells of Pentamera, which abound in this rock and are found in none other in the district.

It may be objected to the proposed nomenclature, that in order to become familiar with the rocks, they must be examined at the designated localities. It is true that this system requires more labor than the study of a few cabinet specimens; which we are sometimes told is sufficient to prove, at sight, every rock on the globe. But thus we shall be enabled to avoid the egregious errors which have led to such false impressions regarding the identity of rocks; and if this system be established, and means taken to ascertain the character of strata, the community may be saved the useless expenditure of many thousands in searching for mineral wealth in rocks where it does not exist. As for example, in digging for coal among the black shales of the Hudson river, and Western New-York, neither of which contain it; though externally they resemble the black shale of the coal measures. Numerous similar instances might be mentioned, where dependance on lithological characters has been attended with vexation and loss; while public confidence in scientific researches, which thus appear to have no sure basis, is gradually diminished.

The course of the rocks, as mentioned in a previous report, varies little from an east and west direction; each being limited on the south by the next successive and overlying member of the series; so that in going south we are constantly ascending in the chronological order, and in going north, every rock is an older one than the preceding. East or west the same rock may be found extending throughout the district. No important disturbances, arising from subterranean action, have yet been found to exist within the fourth geological district; those known are confined to a few undulations or slight downheaves, affecting only a small extent of country, and producing no perceptible change in character or outline.

I have made some attempts to procure topographical maps of the counties examined; but the present county maps are so inaccurate that little advantage can result from any constructed on these as a basis. They cannot be expected to give objects their true location within a mile or two, and can only present the prominent features of a country. Under these circumstances, I have thought it advisable to postpone the subject. A topographical survey of the whole State is a very desirable object and much needed, and to accomplish it in a proper manner, requires much expenditure of time with the necessary instruments to ensure accuracy.

Confined as the annual reports are to facts of utility, the rocks are described under the head of each county, with their localities, changes of character, and other important facts; and where the same rock occurs in more counties than one, reference may be made in the second to the previous description. Thus repetition will be avoided, and easy reference to particular localities secured.

SENECA COUNTY.

" *Saliferous group of Onondaga.*" All that part of the county north of the Seneca lake outlet, with the exception of a small portion south of a line drawn from Waterloo in a northwest direction to Ontario county, is occupied by the "saliferous group of Onondaga." Nearly all this northern part of the county is deeply covered with alluvium; and the rocks appear at very few points. One of these is in the bank of Bear creek, where gypsum was quarried many years since, and another about three miles north of Seneca falls, where gypsum and gypseous marl were penetrated in digging a well.

The great depth at which gypsum is found in the north part of the county will, for the present, and for a long time to come, preclude its profitable exploration. The waters of Seneca lake, which have worn a recent outlet along the southern limit of this series, expose the gypsum and associated rocks near Seneca falls village, and for nearly three miles below. Along this distance the gypsum is extensively quarried. It occurs in irregular, often conical masses, enclosed in a grayish friable marl, with which it is often much intermixed, and in consequence deteriorated in quality.

There is here no evidence that the masses of gypsum have forced up the strata, as noticed in some places in Monroe and Ontario counties. On the other hand the lines of stratification in the marl are continued through the mass of gypsum without interruption. The strata are undulated; the depressions being between the beds of gypsum; and this appearance may have been caused either from the porous nature of the marl by which some of it has been dissolved and carried off, or from contraction, on drying of the mass between the gypsum beds. The latter being a chemical compound, and the force of aggregation greater, on becoming indurated, has contracted less than the surrounding marl; it consequently presents a slight convexity in the surface. In these beds all appearances prove that the gypsum was separated from the marl by chemical attraction, while each was in a fluid or semifluid state. Small particles and seams of gypsum still remain scattered through the surrounding mass, and it very appropriately receives the name of gypseous marl.

The rocks belonging to this formation, were described in the report of last year; they all bear much uniformity in character at different points, and are easily recognized even when the gypsum is not present, by their argillaceous nature, and nearly uniform drab or ash colour on exposure to weather. Some portions are harder and darker; frequently green on first exposure. Owing to the usually soft nature of the strata, they have been removed from extensive tracts, and the space filled with alluvium from more northern rocks; this is particularly the case in Wayne, and the greater part of Monroe counties, as well as in Seneca and Ontario; and from this fact, a principal member of the series, the red shale, has been overlooked. But after knowing the character of this rock, from examining other localities, we find evidence of its existence along the northern part of this formation from the colour of the soil; but after much careful examination, I have not found a point between the Cayuga lake and Genesee river, where that rock is exposed. Near King's corners, in the town of Butler, Wayne county, the soil for some distance along the road is of a deep red colour, owing to the proximity of the red shale: farther west the line of this rock is covered by deep alluvium; in many places coloured by the red shale.

The quarries before mentioned, below Seneca falls, are extensively wrought, and large quantities of the plaster sent westward on the Erie canal, and southward up the Seneca lake, and thence by the Chemung canal; thus distributed over the counties of Chemung and Steuben. I have not been able, accurately, to ascertain the quantity of plaster annually taken from these beds, but believe it to be 5,000 or 6,000 tons. A small proportion only of the vast quantity has been removed, and at the present rate of consumption, it will be long before these beds are exhausted.

That portion of the county south of the outlet and north of the turnpike leading to Cayuga bridge, is probably underlaid by plaster, and the working of the beds on that side of the outlet will gradually lead to its development.

Above the gypsum, at this place, is a compact marl, containing small masses of granular gypsum or selenite, which often appear to have crystallized in the fissures and seams; these being generally separated, and the marl held together by the crytallized mass of plaster. The action of crystallization in this case appears to have taken place after the rock had become partially indurated; and the indurated part of the marl in many places is filled with irregular cavities, lined with crystalline carbonate of lime. This appearance may have occurred from the rock, having been broken up after partial induration, and have formed with the gypsum, then in solution, a kind of conglomerate, as is seen in some rocks below this.

The soft gypseous marl, surrounding the beds of gypsum, could be very advantageously employed on the sandy soils north of Seneca falls, and west, towards Waterloo. The argillaceous matter of the marl would form with the sand a soil of proper consistence; while the calcareous matter, and the small admixture of plaster, thus introduced, would be efficient in promoting vegetation.

The water lime series is the upper member of the "Onondaga saliferous group;" but at Seneca falls, the essential characters of this formation are not developed. The soft marl is succeeded by a grayish blue limestone, very compact and brittle, breaking with a conchoidal fracture, and exhibiting numerous crystalline points. The rock in place is fissured into irregular masses by seams which traverse it in all directions. It possesses neither the colour nor mineral composition of the water lime. Throughout the whole series it is extremely variable; and though in many places possessing all the external characters of good hydraulic cement, it burns into quick lime, or the product being too siliceous will not "set" under water. Depending, as this does, on a certain combination of the ingredients, it is not surprising, that a sedimentary rock, where the materials were transported from different directions, and subjected to the varying action of currents, should often be unfit for purposes where a constant mixture is required. This rock, at Seneca falls, passes into a compact coarse grained mass, and presenting often a geodal structure. The latter character may be seen at the large stone mill in the upper part of the village, where it has been quarried and used for building. The usual accompaniment of irregular or concretionary strata are not visible at this place; the rock passing by insensible gradations into the Onondaga limestone. A few strata of the latter rock are seen south of the falls, and at the quarries near Waterloo; but in general it is not as well marked as in other counties; while the succeeding rock attains a greater thickness, and is more exposed than in the counties westward.

Seneca Limestone. South of Seneca falls, and covering the greater part of an area of five or six miles, occurs the limestone which succeeds the Onondaga. This limestone commences about two miles south of the falls, and extends a mile south of Cayuga village: its southern limit is in a line drawn from this point to Seneca outlet, two miles west of Waterloo. The rock is fine grained, compact, often brittle, and contains thin layers and nodules of hornstone, which have frequently striated surfaces, and are covered with a deposition of carbonaceous matter. They present some analogy to the striated surfaces of portions of the water lime, and some other rocks, but probably cannot have had precisely the same origin. Few species of fossil shells are found in this limestone; the most constant and characteristic one being the Strophomena lineata, a shell which I have not seen in any of the limestones, above or below, though it occurs in the shales above the Seneca limestone, and in the green shale of the protean group. Other fossils are extremely rare in this limestone.

Along the area where this rock is exposed, there is evidence of several downheaves; probably caused by the solution and removal of the soft rocks below. These downheaves are connected with, or produced by the same cause as those more important ones on the east side of Cayuga lake, described by Mr. Vanuxem. No manifestation of disturbance appears on the surface; the limestone is scarcely raised above the level of the surrounding country, and the strata observed in the quarries all dip south at an angle of from 4° to 6°. Noting the amount of dip in these rocks, and finding them to occur frequently for a distance of several miles, we might, at first view, be disposed to estimate it as of great thickness. But in each of these quarries we find precisely the same rocks repeated, and the whole apparent thickness consists of a few strata which have been several times broken up. In going south we pass over the northern edges of strata which have been successively raised to the surface, while the intermediate spaces which would exhibit the faults, are filled with alluvium.

In one of these faults arises a copious spring of pure cold water, from the bed of which and over an area of twenty feet, nitrogen gas is abundantly emitted. The force of the water is so great that the whole pool is kept in violent ebulition, which with the constant escape of the gas gives it the appearance of a boiling cauldron. No deposit of any kind is left by the water, which through its whole course to the lake is remarkably clear and limpid. The water from this spring, and another similar, but much smaller one, near, supplies the Canoga flouring mills, a saw mill and some other machinery. From no other spring in this part of the State is nitrogen gas known to issue; all others known in the State being near the junction of transition with primitive or metamorphic rocks. Should it be proved, as Dr. Daubeny has conjectured, that the production of nitrogen is due to the proximity of melted or highly heated materials, it will be some evidence in favor of attributing the faults in question to subterranean or igneous action. Nitrogen has generally been found accompanying the waters of thermal springs, which fact may give plausibility to this theory; but in the springs of Chateaugay,* where nitrogen issues abundantly, the water is cold, (about 40° Fahr. in summer.) The water of the Canoga spring is probably about the same temperature.

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* Geological Report of 1837.

The principal quarries of the Seneca limestone are those of McAllister, Rorison, and one belonging to the county adjoining the latter; half a mile south of the last is another extensive quarry, and also one half a mile southwest of the Canoga spring. The stone is quarried for buildings and enclosures as well as for burning into lime. The layers do not generally exceed a foot in thickness, and are separated by thin seams of shale. From six to eight courses of the stone are to be seen in each quarry; each course is generally separated by thin seams of shale, and sometimes by a layer of hornstone; two or three of the latter sometimes occur in the same quarry, separating the courses of limestone. The hornstone is more commonly in courses of nodules in the limestone, sometimes one and at other times several courses occurring in the same strata of the different quarries. When dressed with the chisel it forms an elegant and durable material for stepstones, door and window caps and sills.

The Seneca limestone is succeeded by a group of shales of great thickness, and limited above by a thin mass of limestone, (the Tully limestone.) The group consists of several distinct members possessing characteristic lithological and fossil characters. Most of the rocks of the group are highly fossiliferous, containing abundance of shells and corallines, with three genera and four or more species of trilobites. The different members of the group succeed each other in the following order:

I. *Marcellus shales.* The northern boundary of theses shales follows the irregular line noticed as the southern limit of the Seneca limestone, extending across the county from near Canoga to Waterloo, and cropping out at numerous points along the roads and in the small ravines. The lower part is black and slaty, containing limestone in nodules or concretions, and sometimes in continuous strata having a concretionary structure. The fossils are Posidonia, a large spiral univalve, Pleurotomaria ? a spinous Leptaena or Strophomena, like the Leptæna spinulosa, with Orthis of two or more species.

The concretionary strata of limestone, apparently result in the same manner as the nodular concretions; in the former case the quantity of material being sufficient to form a continuous stratum. The concretionary structure and seams of crystalline matter, pervade the whole mass, as in the septaria; and petroleum or liquid bitumen likewise occurs in the cavities, with a fluid of a light blue colour, resembling Prussian blue. The same substance was noticed in the cavities of septaria on Cayuga lake, and is mentioned in Mr. Vanuxem's report.

The shale in some places appears to be composed entirely of small fragments of organized remains, and towards the upper part of the mass is a stratum composed of a species of Orthis, so numerous and so closely compressed that the form and outline of the shell is nearly obliterated. The points where this shale can be seen are, south of McAllister's quarry, along the east and west road on lot 26, and about two miles and a half south of Waterloo; at this place it contains Posidonia and a few other fossils, besides numerous small fragments.

II. *Dark slaty fossiliferous shale*, in Varick and the southern part of Fayette, and of Flint creek, Mud creek, &c. in Ontario county. The upper part of the last described shale becomes very fissile and crumbles rapidly on exposure to the weather. From this it passes into a dark coloured or black slaty shale, readily separating into thin irregular laminæ. Nodules or concretions of limestone are scattered at distant intervals, and never disposed in regular courses. The fossils, both in the contained limestone and in the rock, are entirely different from those in the mass below, being an Orthis deeply striated or grooved, and in the shale very much compressed; and a flattened spiral univalve. At many points fossils are exceedingly rare, and the mass, on slight examination, might be mistaken for a non-fossiliferous one.

This shale is exposed along the shore of Seneca lake for several miles above the outlet, and in ravines across the county. On the Cayuga lake it is well developed along Sinclair's creek near Mr. Wicker's, and in a ravine one mile farther south; also along the lake shore.

III. *Compact calcareous blue shale.* The shale last mentioned graduates into a bluish, more compact and less slaty, calcareous shale; which, in the upper part, approaches in character a blue limestone. Some portions of this mass are sufficiently pure for burning into lime. The two masses together attain a thickness of more than one hundred feet, and the whole is characterized by fossils peculiar to itself. One or two species of Pterinea occur below the more compact portions associated with Cyrtoceras, Orthoceras, a large Delthyris, Leptæna, &c. The Delthyris with a long striated spiral univalve, are found in the more calcareous portions.

This part of the series is easily recognized near Tyler's tavern, on the Seneca lake shore, ten miles from Geneva; also on the ravines on Cayuga lake, near Mr. Wicker's, where its projecting edges produce beautiful and picturesque falls. Its great hardness protects the softer shales both above and below, from the rapid destruction which the streams would otherwise effect. Almost all the ravines where this shale is exposed, appear to have formerly been large water courses, the present streams cutting a narrow channel in the *bottom*, composed sometimes to great depth of water worn fragments of shale, and the rocks above, and covered with soil supporting the largest forest trees. Along the banks of the ravines, the destruction of the shale has produced a thin but rich soil, which, though the rains are constantly washing it down into the valleys below, produces a small growth of trees, and a luxuriant one of flowers, of which a greater variety and in greater beauty, can scarcely be seen. The family of Trillium, the Corydalis, Dentaria, Caulophyllum, Tiarella, and the delicate Mitella, with hundreds of others, spring up in the greatest perfection and profusion. As beautiful objects of natural scenery, these ravines cannot be surpassed.

IV. *Olive shale.* Succeeding the compact calcareous shale, is a more fissile, bluish or olive shale, often containing small nodules or concretions like the claystones, or concretions in common clay: the lower portion of the mass is highly calcareous, partaking of the character of that below; it readily crumbles on exposure to the weather, producing a fertile soil. Above this it becomes gradually more fissile, and of a darker colour, and the fossils gradually diminish, and finally almost entirely disappear. In this rock, for the first time among the shales now described, we meet with a finely striated species of Orthis, which occurs in the Rochester shale. Circumstances, however, appear to have been more favorable to its development here than there, as it appears in much greater numbers, and twice the size of the same in the Rochester shale. Another fossil which existed at the time of the deposition of the Rochester shale, again makes its appearance about this period. Trilobites, which are extremely rare in any of the lower shales of this series, begin to appear here, and attain their maximum a few hundred feet higher.

The upper part of this shale becomes of an olive colour, and separates readily into thin laminæ, which are deeply stained with manganese; it contains few fossils, and those noticed, were fragments of Orthocera.

This rock may be examined to advantage a few miles south of Tyler's tavern, on the Seneca lake shore, for several miles, though in many places, from its ready destructibility, it is broken down and covered with alluvium. On the Cayuga lake shore, the shale can be examined near Shelldrake point, and along the ravine in the neighborhood. The fossils most abundant are Delthyris striatula? Atrypa concentrica, and A. affinis, Cyathophylites, fragments of Trilobites, &c.

V. *Ludlowville shales.* The fissile olive shale, noticed as the southern termination of the last described mass, passes into a more compact form, retaining the colour, &c. but characterized by an entirely different association of fossils. Its upward limit is well defined by a mass of limestone, which contains abundance of encrinal columns. The most characteristic fossils are several species of Pterinea, and a peculiar Leptæna, which has not been seen in any other rock. This shale is exposed from one to three miles north of Hathaway's landing, in Baileytown, on Seneca lake; it also appears in all the ravines which come into the lake near this place.

The same shale is exposed along the lake shore in Cayuga county, near Ogden's ferry, and at Ludlowville. The various species of Pterinea are much more abundant at these localities than any yet seen in the Fourth District.

The Encrinal limestone, the terminating rock of the shale last described, maintains a very uniform and constant character from Cayuga lake to the Genesee river. It never attains a thickness of more than four feet; sometimes it is divided into two or three courses, at other times it consists of one only. It abounds in fragments of Encrinal columns, some of which are an inch in diameter, and from half an inch to one or two feet in length. There is occasionally found in this rock a large Leptæna, and Delthyris, Cyathophilli, &c. no other fossil, however, than the crinoidal columns being constant. The rock is generally tough, and not readily affected by the weather, standing out in bold relief from the surrounding shales. It can be seen in the bank of Seneca lake, one mile north of Hathaway's landing, and about the same latitude on the Cayuga lake side of the county.

VI. *Moscow shales.* Above the encrinal limestone the character of the fossils and shale is considerably changed. The principal part of the mass is of a bluish colour, sometimes olive, and in certain localities portions near the upper part are black. Very little of the whole mass is slaty; it generally separates into irregular fragments, and is traversed by seams in various directions. The lower part sometimes contains fine fossils, but the upper portions are the most prolific in fossils of any rock in the district. Most of the shale is highly calcareous, forming by its disintegration a very fertile soil; it is readily affected by atmospheric agents and rapidly decomposed. Along the banks of the lake, and in the ravines, it is removed by frosts and rains in large quantities, and mingled with the soil, or carried into the bottom lands, where it fertilizes the surface. Calcareous marl and tufa are formed along the water courses, or where water percolates through the loose partially disintetegrating shale in banks and ravines.

This rock contains iron pyrites in nodules and irregularly formed concretions; sometimes the pyrites has, in part, replaced or invested a fossil body; and at other times fossils are studded with minute grains, or points, of the same mineral. Excavations for this substance, under the supposition that it was silver or gold, have frequently been made in the lake shore where it is exposed. A locality of pyrites on the bank of the lake in Ovid, was known to a few individuals only, and the matter kept a secret for several years. Large quantities of the mineral were taken out, always during the night, and after obtaining sufficient, as they supposed, to enrich themselves, one of their number was about to be despatched to New-York to learn the manner of extracting the metal from the ore, when their dreams of fortune were suddenly ended by learning that their supposed gold was a compound of sulphur and iron.

This shale is well exhibited on the Seneca lake shore, between Hathaway's landing and Goff's point. Some part of the mass along this distance is black, and at first sight might be mistaken for some of the shales below, but the contained fossils are always a sure guide. The rock is also exposed by several deep ravines, which extend from the lake along this distance, gradually becoming smaller, to near the centre of the county. On the Cayuga shore this shale is exposed from near Kidder's ferry to within three miles of Ithaca.

This member of the group embraces a thin mass of black slaty shale which contains abundance of Orbicula, a deeply grooved species of Orthis, and a small Leptæna. These fossils are all confined to a few feet of thickness, and are rarely, if at all, seen above or below. The Orbicula is so abundant that in one specimen in the State collection, more than eighty individuals are seen in a space of less than a square foot. The same Orbicula with the Orthis, occur in great profusion in a shale much higher in the series, which will soon be described.

This shale is so well developed, and contains the fossils, particularly trilobites, in such great perfection, at Moscow, Livingston county, that I have given it that name till a more appropriate one shall be found. This member terminates the group, a very marked change occurring in the rocks and fossils, succeeding the limestone which follows. The Calymene bufo, and Cryphæus calliteles are characteristic fossils of this shale

"*The Tully limestone*" succeeds the shales just described: the greatest thickness of this mass of limestone, in Seneca county, does not exceed sixteen feet; but it extends over a great area, maintaining a very uniform character. It is of a light bluish gray colour; in some localities blue, fine grained and very compact; it contains few fossils, and those of the same species as in the shales below. This rock presents many of the characters of the Seneca and other lower limestones; and in hand specimens does not appear to differ from these, but is readily distinguished by its associations from any of them. The mass consists of three or four layers, for the most part of uniform thickness. It is not generally fit for building stone, being traversed by seams in all directions, and breaking into irregular masses. In some localities the whole mass crumbles, on exposure, into small fragments, from half an inch to three inches in length and breadth, but presenting no further tendency to decomposition. The fragments are all clay coloured on the exposed surfaces, resembling in this respect some of the harder gypseous marls.

There are a few localities where this rock is very compact; the layers are from one to two feet thick, and it can be quarried of any required dimensions. Its northern edge extends in a curve entirely across the county. From where it is first seen it may be followed in a northeasterly direction to a point two miles north of Ovid village, where it is quarried for burning into lime, and for various other purposes, on the land of Mr. Thompson Johnson. This point is the greatest northern extension of the curve. From here it gradually bends to the southeast, and appears on the Cayuga lake shore, in a line nearly east from its point of appearance on the Seneca lake shore. This curved outcropping of the mass is merely the effect of erosion; the greatest force of the northern current being in the channels of the two lakes, its force was diminished towards the centre of the county, which consequently left the limestone extending farther north at this point.

This mass being so distinct in appearance from the shales above and below, manifests, very clearly, the beautiful undulations produced by subterranean action upon the contiguous rocks. At the point where the limestone first appears, in a ravine near the lake shore, it is sixty feet above the level of the water; half a mile south of this, it comes to that level, and after disappearing beneath the water for a short distance rises again toward the south and soon disappears from the lake shore.

The ascent to the south continues for more than half a mile, at which point it has attained an elevation of sixty or seventy feet above the lake; here the rock becomes nearly horizontal, and so continues for nearly a mile, when it again dips to the south, and disappears for the last time beneath the lake a short distance south of Goff's point, and four miles from its first appearance. The shale, both above and below pursue the same undulations, proving that this appearance does not arise from the limestone having been deposited in an uneven bed in the shale. From this rock appearing at so great an elevation above the lake at two distant points, it might, unless carefully observed in its southern ascent, be mistaken for two beds, occurring several hundred feet apart; and it is only from investigations along the lake shore, that we are able to point out the precise cause and manner of its recurrence at a point so far south of its outcrop.

Undulations of the strata are not confined to the extent here mentioned, and we shall have occasion to allude to the same phenomenon in rocks farther south; though nowhere so well exhibited as in the case just described. A corresponding undulation is seen in the Tully limestone, on the eastern side of the county, also on the eastern shore of Cayuga, and on the western shore of Seneca lake, the amount being about the same in each place. The points of final disappearance of the rock beneath the water on either side of the same lake are nearly opposite each other, or in the same line of latitude. This limestone generally contains few fossils; in some localities, Calymene, Cryphæus, and Atrypa affinis are found in considerable numbers, and may be considered the characteristic fossils of the rock. The transported masses of the same rock which have been found many miles south, all contain the same fossils, and thus enable us to refer the loose masses to their original place.

The erosive action of the lake waters has removed the shale below the limestone in many places, causing it to fall into the lake, where huge masses are seen to line and protect the shore for considerable distances. In Seneca county these masses are raised from the water and carried by boats to the head of the lake, and up the Chemung canal, where they are burned for lime.

Upper Black Shale. Reposing upon the Tully limestone we have a thickness of 150 feet of shale, exhibiting throughout a uniform black colour, and slaty structure. It differs from the black shale below in being more brittle, the surfaces of laminæ grained or rough, and containing abundantly thin minute scales of mica, requiring only a higher degree of heat to have become a micaceous schist. The greater part of the mass, except the upper part, is almost, or entirely destitute of fossils. In this county it is characterized as containing two species of Lingula, Orbicula, and a species of Orthis, which fossils are constant associates in the upper part of the mass. Farther west it contains other fossils, and finally becomes fossiliferous through its whole thickness.

This shale can be examined in all the ravines along the lake shore from near the north line of Ovid to six miles south. Being succeeded by a harder rock, which protects the upper part from the erosive action of water; the black shale is, in some instances, exhibited in nearly its whole thickness at one view. Among the places where it can be examined to great advantage, is at a fall of water on lot No. 26, in Ovid, and at Lodi falls on the west side of the county, in several ravines on the east side, and at Goodwin's falls in Tompkins county.

The shale is uniform in texture, and before weathering is quarried in symmetrical blocks of various dimensions, being separated by the vertical seams, or joints, which traverse the rocks in two directions, one being from east to west, or from east by north to west by south, and the other varying from NE and SW to N½E and S½W. The direction of these joints is never at right angles to each other, but varying, generally crossing at inclinations of about 75° and 105°, the blocks splitting into rhombic forms. Such joints are not confined to the shale, being very perceptible in many other rocks of the district, though in none so eminently as in this. The black shale is used for a fire stone, and when laid with the edges of the laminæ to the fire, will last for a long time.

Resembling very nearly in appearance the black shale of the coal formation, this rock has often been mistaken for the same, and explorations for coal have frequently been undertaken at great expense, and resulted in final disappointment and loss. Most of the excavations for coal in this part of the State are made in the black shale, or the next succeeding mass, which often contains fragments of vegetables. The emission of inflammable gas, particularly when arising from this rock, is supposed to proceed from beds of bituminous coal. Although the fallacy of such a supposition has been frequently shown, the opinion is still entertained, and the assertion often repeated.

The black shale is sometimes succeeded by a well defined layer of sandstone, a foot or two in thickness; more generally, however, the black shale passes into a more siliceous and compact olive shale, the line of division between the two being sufficiently marked. The shale of this group frequently alternates with thin layers of sandstone, and from slaty becomes more compact. The whole mass consists of alternations of slaty and compact shale, with an argillaceous sandstone in layers from an inch to eight inches thick. The surfaces of the sandstone layers are frequently covered with fucoides, but in Seneca county the most abundant remains are fragments of terrestrial vegetables, which in some cases are so numerous as to cover the surfaces of the thin strata. Some of these fragments are several feet long and half a foot wide, presenting externally the vegetable structure, while the interior is changed to coal. These seams of coal are from a quarter of an inch to one or two inches in thickness. Their occurrence has frequently induced explorations for coal, on the supposition that the thin seams were leaders which communicated with extensive beds of that mineral. It is needless to say that there is no foundation for such belief, all the carbonaceous matter being derived from detached fragments of vegetables deposited with the sediment forming the rocks, and in no case presenting evidence of any large accumulations of the same material.

About four miles south of Lodi village an excavation for coal has been made in the mass. The principal inducement in this case appears to have been pyrites and the sulphurous odor of the water, which is covered with a film so common in water flowing through pyritous or other rocks. Petroleum also occurred in globules on the lower surfaces of the slaty layers, which circumstance was considered by an "old miner," who directed the excavation, as a sure indication of coal. When I saw the place the original excavation was filled with dirty water, and the shales thrown out were nearly dissolved into soil.

Some tolerable flag stones are obtained from this group in the town of Lodi, and Mr. Wyckoff has used the same in the construction of a mill at Lodi falls.

A portion of this group is characterized by certain fossils, some of which differ from any above or below; these fossils are a large Orthocera, Cyrtoceras, Lingula, Posidonia, and a peculiar grooved or ribbed shell, either Avicula or Pterinea.

This group is exposed in many of the ravines south of Lodi village, on the Seneca lake shore, and also in the same latitude on the Cayuga shore, in the south part of Covert, and in the ravines extending towards the middle of the county. The group is also well developed a short distance south of the county line at Goodwin's falls, as will be mentioned under the head of Tompkins county. Near the village of Penn-Yan the same group is perhaps better displayed than in any other place examined. Its fossils being so distinct and peculiar place this in an independent group, or it may be joined with the black shale below, and constitute a characteristic group composed of the two members.

The rocks of this group are the highest in Seneca county, extending southward into Tompkins, where they are succeeded by another group, which will be described under the head of that county.

ONTARIO COUNTY.

In this county we find the same rocks, and in the same general order, as in Seneca. The "*Saliferous Group of Onondaga*," occupies that part of the county which lies north of a line drawn from a point one mile north of Oak's corners, in the town of Phelps, along the course of the Canandaigua outlet to Manchester, and thence west to Victor. The vast accumulation of alluvial, however, leaves the rocks exposed but at few points, which are mostly along streams. In a few cases, what externally appear to be alluvial hills are isolated masses of gypseous marl, &c. deeply covered with alluvium; and in some instances small masses of gypsum have been found in these, much above the ordinary level of the valleys and surrounding country. Admitting that the gypseous mass originally held a higher elevation, and equal to that of the alluvial hills, before the intermediate portions were transported southward, the fact proves the vast quantity of matter removed by alluvial agency.

This group of rocks is much better exhibited in Ontario than in Seneca county; having a greater extent, and in one or two places developing a different character. The gypsum here occupies three distinct ranges; the northern or lowest appearing upon or just north of the county line, and the other two within the county. In the first the gypsum is associated with a gray marl, which reposes on a green marl containing no gypsum. The gray marl exhibits iron stains and decomposing pyrites; and pyrites is also found with the plaster which occurs in small, irregular masses, having a granular or crystalline texture, and frequently accompanied by selenite. Masses of selenite are very abundant in the marl, varying from the size of a walnut to several pounds weight, isolated as regards themselves, and having no connection whatever with the larger masses of gypsum. In appearance and mode of formation they are very analagous to those found in the marly clays of the Tertiary formation. The limpid selenite often embraces a small piece of solid marl, having its faces and edges grooved or striated as in the pseudomorphic crystals of muriate of soda.* The gray marl is also traversed by seams of gypsum, generally flesh coloured or reddish, in such quantities that the whole is ground and sold for plaster. Both the green and gray marl rapidly disintegrate and form a tough clayey soil.

The second series is developed near Port Gibson, and also about a mile distant, at an elevation of twenty-five or thirty feet above the Erie canal. An argillaceous limestone appears on or near the surface in low knolls or hillocks; this rock, on removal, is found to be fractured, as if upraised from beneath, and at the depth of four or six feet, is found a flattened, spheroidal mass of gypsum. It is always of this form, and quite disconnected with the surrounding rock. This gypsum is fine grained, compact, contains no Selenite, and in general appearance is quite different from that last described. The surrounding fractured rock is in thin layers from four to six inches thick, which break into pieces from one to three feet square. The surfaces present numerous little seams or cracks, similar to those produced in clay on drying, and the sides of these are all smooth, and appear worn as if by the passage of water. This character is very constant, so far as has been observed, and serves better than any other to distinguish the rock. The external colour, after weathering, is that of common clay; on fresh fracture, it is bluish, often nearly black. Water is with difficulty obtained along the extent of this formation; the fractured rock beneath admitting the percolation of water so rapidly as entirely to drain the soil, the little hillocks become in summer too dry to support vegetation. Very little gypsum has been obtained from this series in Ontario county, though it seems to be the same which furnishes a great part of that mineral in Monroe county. It will doubtless be explored after the supply along the Canandaigua outlet in Phelps, becomes exhausted.

The third series embraces the gypsum which is extensively quarried in the town of Phelps, between Vienna and the town line of Manchester, along the Canandaigua outlet. West of this point, one or two masses are seen in the bank of the outlet; and with this exception, and a single bed recently opened near Victor, the town of Phelps furnishes all the gypsum from the county. This with its associated rocks are very similar in character to those on the Seneca outlet. It occurs in the same irregularly shaped or somewhat conical masses, producing no disturbance in the surrounding strata; while the lines of stratification in the marl pass through the beds of gypsum, and in several instances where one or two thin courses of hard argillaceous limestone occcur in the former, these also are continued through the latter, the intervention of the rock merely breaking the continuity of the plaster without otherwise affecting it. In this series, the force of aggregation or chemical attraction seems not to have been sufficiently powerful to separate the gypsum from all surrounding materials; consequently we find it much intermixed with the marl, and wherever the attraction of particles was stronger than in either of these, as in the limestone, the strata continued their course through the mass, scarcely interrupted at all. The greater tenacity of the latter may have prevented the mobility necessary to an entire separation of particles, and from this cause in part may arise the admixture of substances.

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* Their form, however, is less regular, and they occur much lower in the series.

The course of the Canandaigua outlet, from Manchester village to near Vienna, is along the line of the Saliferous group and water lime, leaving the latter entirely on the south, and the former, with the exception of a few beds, on the north. East of Vienna, all the marl and gypsum has been removed, and is replaced by a deep deposit of sandy alluvium; in the west of Manchester, the same circumstance is observed, and on the north side of the outlet, instead of the gypsum, we find alluvial hills rising eighty or one hundred feet above the valley, but not appearing south of the stream. From Manchester to the west line of the county, a low valley extends along the southern boundary of the gypseous rocks, with alluvial hills rising on its northern side. The original course of the Canandaigua outlet appears to have been north; and it is very evident from the character of the rocks along which it passes, after turning east, that this portion at least was excavated recently, or long after the deposition of the alluvium, which may have closed its northern egress.

The principal quarries of gypsum are those of Robinson, Norton & Co., Cook, Vandermark & Co., and Hildreth. From these, about six thousand tons annually are ground at the mills on the outlet, and sold within the county. The supply is sufficient for a much greater amount, and unless the demand increases, the quarries will not be exhausted in many years. Whenever this happens, explorations will extend north of the present quarries; and in all the valleys along the north part of the county, the middle series of plaster beds will probably be found.

The water limes are better developed in this county than in Seneca, appearing in their characteristic drab colour. The mass may be traced almost uninterruptedly from near Oak's corners, in Phelps, to Manchester village; and beyond this it appears at many points, as on Mud creek, and near Victor village. East of Vienna, all the strata of this series are highly calcareous, and burned only for common quick lime. The principal quarries and kilns are within one and a half miles of the village. It is also quarried for buildings and enclosures, the layers being sufficiently thick. It becomes stained with iron on exposure, and in almost every locality is highly bituminous.

At Vienna, this rock is burned for hydraulic cement, and is said to form it of very good quality. Two miles farther west at the quarry of Mr. Maffit, large quantities have been used for this purpose. At this place the stone varies little in external characters from that used for lime. It consists of three distinct varieties; two only are used for the cement, while the lower course is composed of thin layers of tough argillaceous bluish limestone, breaking on exposure into small irregular fragments; and in mineral character precisely the same as the strata which pass through the gypsum beds. This portion on burning, melts into a coarse porous slag, externally glazed and yellowish. The second stratum consists of thin layers, externally drab coloured, silicious in texture, and harsh to the touch. This is succeeded by a few layers of irregular thickness, lighter in colour than those below, and much more calcareous. Of the two last mentioned, each at intervals partly takes the place of the other, so that their thickness is variable, and the dividing line takes an undulatory direction. The whole depth of the two masses together varies from three to seven feet. If the lower of these is burned alone, the cement will not "set" under water; and if the upper is burned alone, it is found to be too calcareous, and less enduring than the more silicious cements. To obviate this difficulty, both are burned together, but without regard to proportions. From the nature of the materials, it is evident that the proportion of silicious and calcareous matter must be very variable, and too little attention has heretofore been given to this circumstance, and to the nature of the ingredients, in the manufacture of hydraulic cement.

West of the last named quarries, the water lime appears in numerous localities south of the outlet, and near the road leading from Vienna to Manchester; but here it is used mostly for enclosures, and at Manchester village for building stone, some of the layers being two or three feet thick. It is too soft and argillaceous for hydraulic cement or good lime. Above the village of Fredon, this rock is exposed in all its varieties, for half a mile on Mud creek, and along the whole line from

Manchester to that village it approaches the surface, and could easily be obtained in any required quantity. Thence it extends west to the quarries in Mendon, though the surface of the intervening space is mostly covered with deep alluvium.

At Maffit's quarry, in Phelps, the drab limestone is succeeded by several feet thickness of bluish gray limestone, which divides into thin laminæ by parallel seams; when struck with a hammer, it yields a metallic sound, like some of the trap rocks. On the surfaces of the laminæ are found Cytherina and a species of Orthis, which are the only fossils I have seen in connection with the drab limestone. This rock, when exposed to the weather, presents numerous linear or needle form cavities, frequently almost covering the surface of the stone; these result from the decomposition and removal of thin crystals of strontian which have pervaded the entire mass. Specimens are frequently obtained where the crystals are preserved, and others where they are only partially removed.

The Oriskany sandstone, is well characterized in the Third Geological District, and described by Mr. Vanuxem; it appears but at one point in this county, and not at all in Seneca, being either entirely wanting or deeply covered with superficial materials. This rock could be easily identified did it exist, but I have yet seen it only in Flint creek, at Vienna. Here it is a coarse porous sandstone, destitute of fossils, so far as observed, with the exception of a single specimen of Icthyodorulite; the large Orthis and Delthyris, which characterizes this rock in the Third District being entirely wanting. Its purely silicious character and porous texture are well adapted to withstand the effects of rapid heating and cooling; and at the locality mentioned it is much quarried for free stone, and used in the Ontario furnace, and in the glass furnace at Clyde. It contains numerous small geodes lined with chalcedony; also rounded masses of a dark rock are imbedded in its surface. These, on examination, prove to be very compact aggregations of fine sand, coloured with carbonaceous matter, and may have resulted, as well as the chalcedony, from the long continued action of Thermal waters.

At the place where this rock is quarried, it is four feet thick, divided into two or three layers, one of which is about two feet. It rests immediately on a slaty, argillaceous limestone, four feet thick, which succeeds the water lime proper. The thin layer of conglomerate mentioned in the report of last year as separating the drab limestones at

Tinker's quarry from the gray and blue limestones above, is the representative of this rock, which, we learn from Mr. Vanuxem's report, attains in the Third District a thickness of thirty feet, and contains abundance of peculiar fossils. This rock, the "shell grit" of Prof. Eaton, is a well characterized mass in the Helderberg range, interposed between the upper and lower limestones.

The "gray crinoidal," or Onondaga limestone, which follows the Oriskany sandstone, is well characterized, and distinguished from any other by its peculiar gray or grayish blue colour, and compact crystalline structure. It is tough, breaking with a large conchoidal fracture. When free from seams, it is perhaps the most durable of the limestones, and one of the most beautiful for buildings. For this purpose it is much quarried; and at Oak's corners, its eastern limit in Ontario county, it is also burned for lime. It is very abundant as a surface rock.— In several localities there is a gradual merging of the water limestone into this rock, the Oriskany sandstone, which should intervene, not being in place. In most instances the strata succeeding the water lime are an irregular gray limestone, containing abundance of fossils, mostly in fragments, or single valves of shells. Fragments of Calymene are very numerous, but perfect specimens are rarely or never found. Strophomena rugosa, Orthis affinis, and several others, are abundant. A large species of Orthis, peculiar to the Oriskany sandstone, or "shell grit," sometimes accompanies the other fossils in this part of the formation, and Madreporites, Cyathophyllites, &c. are found above the more shelly portions of the rock.

West of Vienna this limestone spreads out over a great surface, covered only with a thin coating of soil, and having its northern termination about a quarter of a mile south of the Canandaigua outlet. It extends to Flint creek. The principal quarries in this neighborhood are McBurney's and Wayland's, within two miles of Vienna, which furnish materials for locks on the canal, for building and step stones, and some partially crystalline portions, from the unequal expansion, form a good firestone for the ordinary heat of a fire place. At these quarries four layers of limestone are exposed, two of which only are workable, the others being too thin, or separated by seams. The upper one has in many places been nearly destroyed by the action of running water. Sometimes layers of chert, or hornstone, are interspersed between those of the limestone; and some of these contain much of that mineral, while in others it occurs only in small nodules. In such cases it does not injure the quality of the stone, but where it occurs in large masses the surfaces cannot be worked smooth, and where the stratum in place has been exposed, the mass is often fractured around the hornstone.—When the lower layers abound in chert, they contain few or no fossils, while those containing little of it are filled with them. Further west this rock is exposed at many points; at the Manchester sulphur springs, half a mile and two miles west of this, and again in the outlet a mile above Manchester village; from this point it preserves nearly a west course to Mud creek, near the residence of Judge Lapham.

Last summer I examined a quarry of the same rock in Livingston county. This is opened for the purpose of supplying stone for the construction of locks on the Genesee Valley canal, and the engineer will do himself credit, as well as secure the permanency of the work, by using these in preference to any of the sandstones south; although the expense of transportation will exceed that of others which might be procured on the line of the canal.

The Seneca limestone succeeds the Onondaga, and in some instances alternates with it. In Ontario county it follows the same course, and can be seen a little south of the outcropping edge of the Onondaga limestone. It is recognized by its darker blue colour, fine texture and homogeneous structure; it is generally very brittle, breaking with a slight blow of the hammar, while in some localities it furnishes stone fit for building. Like the Onondaga, it contains much chert or hornstone. At its eastern termination in this county, about half a mile south of Oak's corners, on the land of Mr. Jones, it presents six distinct strata, each separated from the next by a thin layer of shale or hornstone.

The upper stratum bears evidence of the erosive action of water, as of a powerful current bearing hard substances along in its course. At this point the limestone suddenly terminates, as if broken off and removed, leaving an abrupt descent to the east; and reappears at a distance of six or seven miles near Waterloo. The mass of limestone has evidently been removed from all the intermediate space, which once formed part of the valley of Seneca lake; and not only this rock, but all those in the same line north, as none are seen until we approach the shore of lake Ontario. In numerous places the bays extend inland towards Seneca lake, with which, probably, they originally communicated, while the great depth of alluvium in many places along the shore of lake Ontario, conceals the rocks if they are present. The limestone is also removed from the space occupied by the waters of Cayuga lake, which fill the valley covered, in the former case, with alluvium. The beds of both lakes seem to be where the strata were originally more depressed than either on the east or west, consequently at a period when the whole surface was covered with water, this would be the natural course of the current. From some cause it appears to have divided and taken the two channels of Cayuga and Seneca lakes, and to have found its outlet far south, after joining other currents from different quarters.

From Jones' quarry we trace the limestone westward. It appears on Flint creek, above Vienna, and at several points along streams between this place and the Canandaigua outlet. In the bed of Flint creek, and also on the outlet, it contains a large quantity of hornstone, which, on weathering, gives the mass a peculiarly rough and ragged appearance. It is exposed in the bed and banks of Mud creek, at Lapham's mill; and here we procured a fine specimen of Icthyodorulite. This fossil has been found in the same limestone at Waterloo; and an exceedingly beautiful specimen is preserved in the cabinet of David Thomas of Aurora. At the last named locality in Ontario county, the upper part of the Seneca limestone is light gray or almost drab, very fine grained and compact; it contains a trilobite, Asaphus, with the post-abdomen armed with two spines, and well merits the appellation of spinulurus. This rock is quarried in many places, both for building stones and lime. For the latter purpose the upper layers are preferred; they break readily into thin pieces, and contain great numbers of Orthis affinis, or a similar one, and Strophomena rugosa. Quarries are worked near Oak corners, along the Canandaigua outlet at Bates' mill, Gardners, &c. west of the outlet between this and Mud creek, and other places.

The Seneca limestone embraces a shaly stratum, containing great numbers of a small fossil, resembling a Cytherina, so minute as scarcely to be distinguishable by the naked eye; and in some instances the stone is literally made up of these shells, appearing to have been once a living mass. This stratum is well exhibited in Mud creek, on the Canandaigua outlet at Short's mill, and near the Eagle mill on Flint creek; through which extent it bears a very constant character.

The Onondaga and Seneca limestones occupy, throughout this county, a width of two miles; varying somewhat along the streams which have exposed the southern rocks and worn down their northern edges, leaving a slight curve to the south. The whole northern edge of these rocks presents an undulatory or indented outline; some points extending a mile further north than the alternating indentation.

The course of the limestones just described, can be easily traced by the elevated terrace formed by the line of their northern outcrop. Their superior hardness withstood the erosive action of water, while the softer gypseous rocks, and water limestones on the north, were excavated to a much lower level, producing in one case a valley, in the other a corresponding elevation. Where this terrace is unbroken, the alluvial hills for the most part terminate in the valley north, or on the gypseous formation; and the deposition of transported matter in such abundance along this line, is doubtless owing to the partial check which the current received from the limestone elevation south.

The terrace here described, must not be, as it often is, confounded with that extending east from Lewiston, the mountain ridge; the latter is entirely a different rock, though the outline is produced by similar means and from similar causes. The mountain ridge is not perceptible east of Rochester.

In this county, as in Seneca, the black shale succeeds the Seneca limestone; and possesses the same essential characters. It appears in the banks of several small streams in the eastern part of the county, though its immediate connexion with the limestone has not been observed. On Flint creek, three miles from Vienna, this shale is extensively developed. The lower part is compact and highly bituminous; it contains much pyrites, and the decomposing shale effloresces large quantities of sulphate of alumine. On the Canandaigua outlet it is not so well developed; nor at any intermediate point; for the force of the original water having widened the channel, leaves the shale now covered with alluvium. On Mud creek, it is seen above the locality of the Seneca limestone, near Hill's mill.

The different members of the shale series succeed the last mentioned in the same order and with the same characters as in Seneca county. These I shall speak of together, deferring the minute distinctions to a more detailed report. Several members of the group are well exhibited in the ravines and on the shore of Seneca lake, above Geneva. Along Flint creek, from two miles below Orleans to the village of Bethel, they are seen in great perfection. The upper mass is particularly well developed at Monteith's point, on Canandaigua lake, and the Encrinal limestone appears about half a mile below. The shale is seen in many places along the eastern shore, and in all the ravines entering the lake, for seven or eight miles south of Canandaigua.

The mass of encrinal limestone, which has already been mentioned as dividing the upper mass of shale from that next below, occurs in great perfection along this lake. Large masses have been transported to the foot, and lie along the beach and in the wall which protects the road from the action of the water. Some of the these boulders contain few or no encrinal columns, but their other characteristics refer them to this formation.

Along Mud creek the shales may be seen at various localities, and in all the large ravines; but in the smaller ones their decomposition has formed a soil which in many cases conceal the rock. In the western part of Ontario, and particularly west of Mud creek, the alluvial hills have covered the underlying rocks as far south as the extent of these shales; while in other counties the southern limit of the high alluvial hills is generally, except in valleys, the limestone range before described.

The Tully limestone I have observed but at two points in Ontario county; one in the bed of Flint creek at Bethel, and only visible when the water is low; the other four miles northwest of that village, near the main road and about a mile from the north line of the town of Gorham; there it consists of a single layer three feet thick, and exhibits the characteristics of that rock. This point is on the elevated land between Flint creek and Canandaigua lake; the surface slopes in either direction towards the valleys, which are valleys of denudation. These produce very irregular lines of outcrop.

West of the point last named, I have not seen this limestone, although its place in the shale is well defined for many miles along Canandaigua lake.

The line of distinction between the lower shale and the black shale succeeding the Tully limestone, is well defined as far west as the Genesee valley. It occupies the southern part of the town of Seneca, and appears in some places in the more elevated parts; and in Gorham extends several miles north along the high ridge between Flint creek and Canandaigua lake West of Canandaigua lake this shale spreads out over a much greater extent of country, passing through the towns of Cheshire, Bristol and Richmond, and becomes fossiliferous in all its parts. It appears on Mud creek and in the ravines and streams about the outlet of Honeyoye lake. The burning springs, so called, of Bristol, proceed from the carburetted hydrogen, arising from this shale; the numerous localities will be mentioned in another place.

The group succeeding the black shale occupies the towns of Naples Canadice, and the south part of Bristol, and presents the same essential characters as described in Seneca county. Alternations of compact shale and argillaceous sandstone compose the group. The sandstone portions are used for flagging stones, and when sufficiently thick, for building stones.

These rocks are seen to great advantage in the deep ravines about the head of Canandaigua lake and in the banks of the Honeyoye, Canadice and Hemlock lakes. These three lakes at present join their outlets, producing the Honeyoye creek, which has been excavated since the deposition of the alluvium; and the rocks are exposed along its whole course. The original outlet of these valleys was probably farther east, and joining the present Irondequoit, passed into Lake Ontario by that channel. These valleys also extend south, and meet the Conhocton, showing that at some former period the course of the water was not restricted within its present limits, but extended south to the Tioga or Chemung. Thus a stream whose width embraces the valleys and beds of the lakes in this direction, may have passed southward from Lake Ontario to the Susquehannah; or, otherwise, a stream from the south may have flowed along the Conhocton and these valleys to Lake Ontario. It is quite evident, from the extent of the valleys and the alluvium piled up in their course, that few of our streams in an earlier geological era had their present origin, or were limited to their present extent. Every valley and every rock bears marks of the great current, of which small under currents merely wore the course of the present valleys, while the mighty whole passed over the highest points of our hills.

YATES.

The rocks of the greater part of Yates county correspond with those of the southern portion of Ontario, and only the most elevated parts of the towns of Barrington and Starkey contain other rocks.

The black shale above the Tully limestone, occupies the north part of the towns of Middlesex and Benton, the southeastern part also of the latter exhibiting this shale and the rocks below; the superior rocks having been removed over that part of the country east of a line drawn from Penn-Yan to Seneca lake, near Bellona. The outlet of Crooked lake, now narrowed to a small stream, once flowed northeast along the valley from Penn-Yan, nearly in the direction of the east branch continued.

From Penn-Yan to Seneca lake, the southern limit of the upper black shale is the right bank of the outlet, where both this and the succeeding rocks are seen to crop out. The present outlet has cut itself a channel through the upper black shale, the Tully limestone, and about one hundred feet into the shale below.

Northwesterly from Penn-Yan to Shepherd's quarry and the adjoining ravine, we find the group of argillaceous sandstones and shales next succeeding the black shale. At this place the lower portion of the mass consists of hard and soft strata, containing much iron pyrites and large fragments of carbonized vegetables; and occasionally other fossils which are characteristic of the group, as the large Orthocera and a Pterinea. Above this are thirty or forty feet of shale, containing Posidonia in great abundance, and embracing a single layer of striped sandstone. This shale is succeeded by two layers of sandstone, and these are again followed by a thick mass of shale.

The lower part of the group furnishes large and fine flag stones, which are used in the streets of Penn-Yan. These thin layers often contain small irregular concretions, surrounded by a coating of shale which soon disintegrates and the concretions become loosened, in many instances injuring the stone. Some of these strata are shaly and soon wear away on exposure.

This group appears about a mile south of Penn-Yan, in Sartwell's ravine; where its connection with the black shale below is very evident; the characteristic Lingula of the latter are found in abundance, and succeeded by a thick mass of more silicious, non-fossiliferous shale.

The same group extends west through the towns of Jerusalem and Italy, and appears in many of the streams and ravines near the west branch of Crooked lake. The thin layers of sandstone are used throughout the country for step-stones, foot-walks, and in many instances for enclosures, though rarely for building stones.

It is chiefly along Crooked lake outlet that we find any rocks below the groups last described. Here, in the descending order, are the black shale, the Tully limestone, and the upper member of the group next below, (Moscow shale,) consisting of bluish or olive and dark shales with an abundance of fossils. Descending the outlet about a mile and a half from Penn-Yan, the black shale first appears, forming both banks of the stream as far as Mallory's mills, sometimes rising forty or fifty feet above the bed of the stream, and at others merely visible beneath the alluvium; as in most localities east of Canadaigua lake, it is almost destitute of fossils. On the south bank near Mallory's, a road cut through the shale exhibits it to great advantage; also Bruce's ravine farther south. Next succeeds the Tully limestone seen at Wait's mill, where the water of the outlet falls over it. Thence it dips east for more than half a mile and disappears, and shortly afterwards it reappears, dipping to the east. No dislocation or disturbance of the rocks is visible at any point, and the change appears to be owing to an undulation, similar to that observed on Seneca lake, which is at right angles with this. The ascent of the limestone to the east, or its dip west, is about ten feet in the mile, as ascertained by tracing it through that distance. At Hopeton, the limestone is sixty or seventy feet above the bed of the stream, and about one hundred feet above the lake. Beyond this point, it has been entirely swept off by the waters of the original outlet.

The Moscow shales are seen at Wait's mill, and also at Mallory's mill, and along the bank of the stream to within half a mile of the lake shore. At Hopeton, about sixty feet of it is visible, containing the usual fossils in abundance. Here the shales and Tully limestone are beautifully exhibited in a little conical hill, which stands isolated in the valley of the outlet, a monument of the power of ancient waters. The hill is about one hundred feet broad at the base, and perhaps eighty feet high. The first sixty feet are of the shales last described; then succeeds the Tully limestone, and the top is capped with a few feet of black shale.

The same undulations as those noticed on the east of the lake, occur on its western shore south of Dresden. The Tully limestone and black shale soon disappear below the level of the lake, and the next series continues to dip in the same direction, till within one or two miles of Big Stream point, or about eight miles from Dresden. Here the rocks begin to ascend to the south, and half a mile south of Big Stream, the black shale appears above the lake, and continues rising for a mile or more, where it attains an elevation of forty feet above the water, and begins to descend southward.

A circumstance worthy of notice is that at this point, and extending as far as the shale continues above the level of the lake, this rock contains within five or six feet of its upper surface, a concretionary mass of silico-argillaceous limestone, from three to five feet thick, consisting of three layers divided by interposed seams of shale. The lower stratum is irregular and more concretionary, sometimes appearing to be merely individual masses of Septaria joined at their edges. It occupies nearly the place of a course of Septaria elsewhere occurring in the black shale: it doubtless results from an aggregation of a greater or less proportion of calcareous matter; so that what in one place becomes a few isolated masses of Septaria, in another is a continuous stratum four or five feet thick. Above and below this are the usual fossils of the upper part of the black shale. This limestone is burned and used for hydraulic cement in mill dams, at Big Stream point and elsewhere; and is considered better than any obtained from other quarters. Mr. Townshend, of Big Stream point, is now erecting a mill for grinding it after burning. The mass is situated in the bank of the lake, where boats can approach for loading, and thus the facilities for transportation will be great. If it prove equal to the expectations of the proprietor, it will supercede much of the material now used as hydraulic cement.

Between Seneca lake and the east branch of Crooked lake, a high ridge or elevated plain slopes gradually to both, being divided transversely by the ravines and streams. Another elevated table land, varied by slight undulations, rises between Seneca lake and the valley of Flint creek, which extends to the head of the west branch of Crooked lake; this is interrupted by a depression to the northeast of Penn-Yan. Another similar portion, though more irregular, rises between the valleys of Flint creek and Canandaigua lake; and the part of the county between the two branches of Crooked lake terminates in a high bluff, called Bluff point. From near the head of the west branch, extending quite across the peninsula, is a valley which appears once to have connected the two branches; the highest point is now not more than one hundred feet above the lake. The soil of this county ranks among the first in quality.

TOMPKINS.

The northern portion of this county, between Seneca and Cayuga lakes, is underlaid by rocks of the group last described in Seneca county. These, as well as the rocks below the black shale, Tully limestone, &c. appear in all the deep ravines communicating with the lakes, and are finally exhibited at the gorge of Goodwin's falls. This is an immense chasm, into which the water descends perpendicularly one hundred and ninety-three feet, from the bottom of which we see the amphitheatre of rocks rising around us, and by the effect of perspective, closing over us three hundred feet above our heads. The black shale visible for eighty feet above the Tully limestone, is succeeded by more than two hundred feet of the next series, before described, consisting in the lower part of a mass of silicious shale, and above alternating with argillaceous sandstone. The surfaces of this rock are often rippled and covered with minute fragments of vegetables, which seem to follow the course of the marking, and accumulate or diminish with the ripple wave. The same appearance is presented by a beach of sand, where the ebbing tide leaves fine fragments of vegetable matter arranged in quantity and direction proportionate to the wave.

These layers of sandstone furnish the finest flag stones in the county, being of any required thickness, and often twenty feet in length, and from five to ten in width.

The Tully limestone and the shale below disappear on Cayuga lake, four miles from Ithaca, the black shale extending about two miles farther south; and on the western side of the county, in consequence of the greater elevation of Seneca lake, the black shale disappears near the southern boundary of Seneca county, with the exception of a small portion rising above the lake, which results from the undulation farther south. The succeeding group of shales and sandstones approach the level of Seneca lake north of Hector falls, and Cayuga lake near its head.

The Ithaca group follows the rocks last described. Like the preceding, it consists of alternations of shale, both slaty and compact, and argillaceous sandstone, but differs from it in the contained fossils, and in some particulars of its lithological character. It sometimes contains thin layers of impure limestone, the calcareous matter arising principally from the contained shells. This group is well characterized in Ithaca, at the inclined plane of the rail-road; it extends also much above the rocks here visible, attaining a much greater thickness, as can be seen in the valley of Chemung, south of Seneca lake. In the rocks of this series, individuals of two species of ferns have been found, precursors of the great abundance of that tribe in the coal formation; and among the many testaceous fossils, are Producta, Leptæna, Orthis, Pterinea, &c. These diminish farther west; a few only of the more characteristic, occurring on Seneca lake.

With the deposition of the Tully limestone, the family of trilobites ceased to exist; yet we find with the characteristic fossils of this group, the buckler of Dipleura Dekayi and Calymene bufo, with other fossils which lived at the period of the deposition of the Moscow and Ludlowville shales. These fragments being the lighter part of the animal, were floated upwards with the detritus of the lower rocks, and deposited at this era. Similar instances occur in some of the lower rocks; but the occurrence of such fossils is not to be considered as characteristic of a rock, or as evidence of their existence at the time of its deposition.

At Hector falls, and above, we find about four hundred feet of this group exposed; the lower part contains the ferns of Ithaca; and above, some of the other fossils. At this place, we find a few thick layers of sandstone, very compact and firm, which have been quarried by Mr. Lawrence. Few durable building stones are found in this county, if we except this sandstone, which however is little used. It furnishes the fine flagstones used in Ithaca, and elsewhere. In general characters it differs but little from that of the group below; but Fucoides are found in greater quantities on the surfaces; many stems of which attain a diameter of two or three inches. One species, the most abundant, occurs on the under side of the layers, as if growing on the bottom of mud and clay, when overwhelmed with the inundation of sand. This species is always straight or anastomosing at various angles; sometimes presenting imperfect reticulations, and at other times, a fancied resemblance to a bird's foot. It occurs on many layers, through a considerable extent, though separated by thick masses of shale. The surface of most of the layers is smooth, or even glazed with a thin coating of shale, which appears to have flowed over it, leaving marks of unequal deposition, and little ridges or prominences where the paste was less fluid. The deposition of these shales and sandstones progressed slowly, considerable time having elapsed between the deposition of the different layers; and in some instances a lower stratum became partially indurated before the succeeding deposit was made. There are numerous proofs of the general operation, and in particular of the latter, where we find, near Jefferson, the surface of a layer worn smooth and grooved, as if by a current, transporting some hard body over it. The scratches do not present the roughness of alluvial scratches, but appear to have been made before the rock was entirely indurated, or else they have been modified by the deposition of shale which succeeded. In this instance I have not been able to ascertain the direction of the current, though it was probably from the north, and like all other currents in the ancient seas, took the direction from the greatest elevations to the lowest point

In some localities the sandstone is replaced by a kind of sandy shale, being a mixture of sand and clay; and the whole is rippled, the markings affecting each thin layer, and showing that it was deposited from water in motion which might transport from different directions the two materials of the rock. This group appears to have been deposited from an ocean alternately at rest, and disturbed. Thick masses of sandy shale occur, bearing ripple marks through their whole depth; these are succeeded by others of variable thickness, without ripple marks, and having the faces smooth and plain. Numerous alternations of this kind have been noticed through many hundred feet. Fossils never accompany the rippled layers, but are invariably found with the smooth. The materials of the two differ very slightly in mineral composition, the rippled ones being more sandy. The absence of fossils in the latter may be explained, by supposing the unquiet state of water during the deposition of the rippled shale to have been unfavorable to the development of organic life. So far as I have observed in this and other localities, the greatest accumulation of fossils is always accompanied by fewest ripple marks.

The changeful state of our planet at that period may have occasioned numerous risings and sinkings of the crust, some portions of which may have been disturbed oftener than others; one undergoing the oscillatory movement while another was at rest. This may be considered proved from the fact that undulations are exhibited in some localities, while a distance of a few miles shows a plane and undisturbed surface. Thus the undulations of the rocks on Seneca lake have not been communicated to those on the western shore of Crooked lake; although the latter are part of the same mass, separated only by a distance of ten or twelve miles. The valley of Crooked lake could have had no influence in interrupting the motive force, as probably at that time it was not excavated; and farther south we find other undulations of which the counterparts are exhibited on each side of the valley.

These uplifting movements would form bays, or protect certain portions of the sea where animals might exist in great numbers, while every other part for miles in extent, were too unquiet for the development or preservation of animal life.

In numerous localities of these rocks, the edges of strata, when exposed in ravines and other places, are found covered with crystals of sulphate of lime. This circumstance is by no means universal among the shales below, although observed in some localities; while in the present group there are few exceptions. Pyrites, in minute particles, is every where disseminated, decomposing on exposure, and hastening the destruction of the rocks; while the sulphuric acid combines with the minute proportion of lime which they contain, exhibiting the crystals along the edges. Wherever larger masses of pyrites occur, we find a proportionate increase in the quantity of sulphate of lime. Similar conditions in some of the limestones below have produced a mass of gypsum, filling the cavity previously occupied by the pyrites; and analogous circumstances, and varying in extent and effect, may have formed the vast gypsum beds of the same series, extending throughout the whole of Western New-York. The latter however could only have occurred before the entire induration of the surrounding rocks.

CHEMUNG COUNTY.

In this county, the group last described forms the surface rocks of the northern towns; and in the ravines and valleys, extends south to the southern line of the towns of Veteran and Catlin. The rocks here retain most of their essential characteristics; but fossil shells are exceedingly rare, and in many localities entirely wanting. The peculiar fucoidal markings are every where preserved in the thin layers of sandstone. The rocks of this group are well developed in Gulf creek, near Jefferson, at the head of Seneca lake; and at many points south on the west branch of the valley, and the ravines coming into it.

From Jefferson to Millport, the rocks dip south, exhibiting throughout continued alternations of shale and sandstone; and towards the upper part the compact shale is covered with fragments of a Fucoid, different from those below, and appearing only in curved fragments.

In the vicinity of Millport, and farther south, the sandstone layers attain a thickness of a foot or more, and are quarried for works on the canal and various other purposes; and at Pine valley, the sandy layers of the rock, are quarried in two places. Mr. Sexton, the owner of the last, informs me that the firmest layers of sandstone often pass into shale so as to be unfit for any economical purpose. This appears to be unlike the thinning out of the layer; but the proportion of argillaceous matter becomes so great that the mass crumbles on exposure.

At the last named quarry, I observed the singular fact of non-conformable strata, as yet the only instance noticed, and which various circumstances seem to render incredible. The strata are parts of the same mass, once continuous, the lower dipping south at an angle of four or five degrees, and the upper dipping north at about the same angle; and a short distance farther south the whole mass dips north. The only explanation that now offers, is that at the time the rocks were subjected to the force which produced the undulations, the upper part slipped over the lower, and at this point partook of the elevation south; while the lower was affected only by the uplifting to the north. The point of the greatest depression is a short distance south of this locality. In this quarry was found the only specimen yet seen of a fern of the genus Sphenopteris; and through the liberality of Mr. Sexton, to whom I am farther indebted, I am enabled to place this specimen in the collection of the State. With the exception of the curved fragments of Fucoides, the upper part of this group is nearly destitute of fossils.

Chemung group. The tops of the hills and high grounds in the towns of Erin, Veteran, and Catlin, display a group of rocks and fossils very distinct from those last described. The essential difference is the lithological characters of the sandstone of this group in the absence of argillaceous matter in most of the layers, these being nearly a pure siliceous rock, harsh to the touch, and generally of a porous texture; while still a large proportion of the mass consists of compact shales and argillaceous sandstones of a softer texture than those below. The surface of the sandstone layers is rough, while those below are smooth and glossy, and being never rippled, prove that the rocks were deposited in a quiet sea.

A great variety of beautiful and characteristic fossils occur in the sandstone as well as the shale; many different from those of the group below, while several species exist in both. The principal ones are a species of Delthyris, the shell on each side extending into a wing, (D. Alata?) a Leptæna, Orthis, and a species of Avicula or Pterinea, ribbed like the common Pecten; besides several others of genera and species not before seen in the upper rocks.

The most northern extension of this group appears on the top of Buck mountain, near Millport, and on the high ground farther west; whence it is traced in the same direction to the valley of Port creek, on the western boundary of the county. The same rocks are found on the hills in Erin, and loose masses from above are scattered through all the low grounds hence to the Chemung river.

At about the latitude of Horseheads, in the northern part of the towns of Elmira, and Bigflatts, this lower portion of the Chemung group approaches nearly to the level of the valley. At Mayber's quarry, a mile and a half east of Horseheads, the rocks are quarried for the sandstone which is used for flagging, step stones, &c. These layers are highly siliceous and compact; and sometimes contain a few fossils. They alternate with thick masses of shale; often several layers of the former separated by thin seams of the latter; and again, a thick mass of shale containing little silex and no sandstone. A similar quarry has been opened by Mr. Tuilegar, four or five miles east of Elmira; and here the layers are very uniform, from half an inch to two inches thick, and dividing by the vertical joints into slabs from six inches to two or three feet wide, and from four to six feet long. The sandstone contains a few species of Orthis, but the greater proportion of fossils are found in the shale. Wisner's quarry is near the junction of this group, with the Ithaca group below, or rather in the upper part of the latter, which appears at this point, the rocks rising southward from Horseheads to the Chemung river.

The rocks of this group, containing an abundance of fossils, occur on a small creek coming into the Chemung valley from the northwest, and also on the Sing Sing creek, passing through Bigflatts. On the south side of the Chemung river, in Southport, the banks of the valley exhibit the rocks of this group with their peculiar fossils.

Between Elmira and Chemung they are seen at numerous points, but no where in the county so well as at the Chemung upper narrows, about eleven miles below Elmira. Here the excavation for the road along the margin of the river has exposed more than 100 feet of rocks, containing abundance of the characteristic fossils, and in their greatest beauty and perfection. At a certain point in the mass exposed, we find a peculiar coralline fossil, confined to a thin stratum, and extending along the whole distance of the exposed rocks; it has also been found at other localities.

The mountain above the rocks exposed, at Chemung narrows, rises 400 or 500 feet, and is probably capped, as some of the hills in the neighborhood, by the conglomerate, which is the limit of the Chemung group upward. Farther south, near Tioga point, rocks of the same group occur in the bank from 100 to 200 feet above the river, and some of the sandstone layers are 3 or 4 feet thick, and highly silicious. I was informed that on the top of the hill the conglomerate is quarried for use on some of the public works below Tioga point.

At the Chemung upper narrows, and at several other localities, there occurs in this group a stratum of concretionary sandstone of a peculiar character. In a few instances only are the concretions perfectly formed, but generally have one side imperfect, with a solid nucleus partially surrounded with concentric laminæ, which easily separate from each other; these are used for water vessels, &c. the concavity being often so great as to contain several gallons.

In the valley of Cayuta creek the group is exposed in a ravine three miles north of Factoryville, where fine flag stones could easily be obtained. In the north part of Barton are great numbers of loose masses containing the fossils of this group, probably washed down from the tops of the hills in the vicinity.

A group so characteristic and so well defined in the valley, and particularly in the town of Chemung, merits the appellation of the Chemung group.

The topography of this county is very simple; the Chemung river passes through the southwestern part of the county, and opens a broad and beautiful valley, bounded by a range of hills which are only broken by the lateral streams flowing to the river; the rocks on one side sometimes approach the river, while on the opposite is an extensive flat or bottom. Here, as elsewhere, the rocks on both sides of the valley bear evidence of erosion, and show that this river, as well as other streams, flows in a bed once occupied by rocks like those of the mountain mass.

The eastern boundary of the county is along the valley of Cayuta creek, which has its origin in the small Cayuta lake, in the north part of the county, and forms a continuous valley thence to the Chemung river. Wynkoop's and Baldwin's creek form valleys of less importance.

The Chemung valley, extending from the head of Seneca lake to the Chemung river, is the most prominent feature in the county. It offers the only route by which a canal could have been constructed, being through its whole extent alluvial, and presenting no remarkable elevations. The ascent from Seneca lake to the summit level of this canal, is 440 feet in a distance of fifteen miles.

STEUBEN COUNTY.

The examinations in Steuben county during the past season, were principally confined to the eastern and southern part, along the valleys of the Chemung, Canisteo and Conhocton rivers, the valley of Crooked lake, &c.; and beyond this, some other points of interest, with one or two reputed localities of coal, which prove like all others of the same kind, a fruitless enterprise.

The rocks of that part of the county examined, belong principally to the Ithaca and Chemung groups, varying in some slight degree from these groups farther east. Along the western shore of Crooked lake they consist chiefly of sandy and slaty, or argillaceous shale, the former rippled or undulated, showing that each thin layer of the shale was subjected to the action producing the rippled surfaces, and this action continued uniform throughout the whole deposit. Alternating with the greenish shale just noticed, is a darker slaty shale containing fossils. At some localities occur a few thin layers of sandstone, but these are not abundant until we approach the head of the lake.

Four miles below Hammondsport, in a ravine on the bank of the lake, can be seen a concretionary stratum of impure limestone, composed of roundish or irregular masses cemented together by an argillo-calcareous cement. In other localities, the concretionary forms are not so distinct, and the whole bears the character of an irregular mass, separated in various directions by thin seams of shaly matter. So far as examined, this mass bears a very uniform and constant character; it disappears beneath the lake on the east side, one mile below Hammondsport. This limestone has been burned, but found too impure for quick lime, though it possesses some of the characters of water lime.

At Hammondsport, in the ravine above Mallory's mill, we find about three hundred feet of rocks exposed, belonging to the Ithaca group; they are well characterized by the fucoides resembling a bird's foot. Few fossils other than fucoides appear through this thickness, though higher in the ravine, are some fossils peculiar to the group. The mass exposed consists, in the lower part, principally of shale and thin layers of sandstone, and at a higher point numerous layers of sandstone from four to ten inches thick. The edges of all the layers exposed, are covered with crystals of selenite, or crystallized gypsum.

About one mile from the mouth of this ravine, an excavation for coal has been made in the black shale, which alternates with the sandstone and olive shale. The indications of coal at this point were a few fragments of vegetables, iron pyrites, and the odor of bitumen arising from the shale; all these were supposed to be unfailing evidences of coal beneath. The work is at present abandoned until some new excitement or reported exhibition of burning gas, shall induce others to engage in the enterprise. In the shale thrown from this digging, I found Inoceramus, Ptenirea and several other fossils.

On the east side of the valley, opposite Hammondsport, a similar ravine exposes the same strata as those just described.

Similar exhibitions of the rocky strata occur in the deep ravines between Hammondsport and Bath, and also in the high hills about the latter place. About four miles north of that place, we find the rocks and fossils of the Chemung group. One mile northwest of Bath occurs a stratum of very tough argillo-calcareous rock, three feet thick; the mass is filled with fragments of crinoidal columns, presenting surfaces like the finest birdseye marble. Should the rock be of such a quality as to receive a fine polish, it will be a valuable acquisition to the mineral wealth of the county. A large species of Leptæna and Delthyris occur in the lower part of the mass.

The rocks of the Chemung group continue along the valley of the Conhocton to Painted-Post, and as far up the Tioga as the south line of the State, the tops of the high hills excepted, which are capped by the conglomerate in a few places.

The valley of the Canisteo is bounded on both sides by almost unbroken ranges of rocks of the same group.

The same rocks are seen along the valley of Five-mile creek, and also those of the Ithaca group. This valley appears to have been formerly a continuation of the Canandaigua lake valley, and the communication between that valley and the Conhocton.

The soil of Steuben, though not as favorable for the production of grain as the northern counties, is one of the best sections for grazing. From the valleys, the high country seems broken and uneven; but this is confined to the immediate edges of the hills, for after ascending the table land, we find a beautiful undulating surface, which when farther cultivated and cleared of forests, will prove one of the best grass-growing regions in the State. These remarks apply also to Chemung county; and in all the elevated portions of both, the water is pure and soft.

The facilities for communication in this county are very great, and when the New-York and Erie rail-road shall be completed, the lateral valleys will afford thoroughfares from all parts of the county. Uneven as its surface is represented, the valleys of the Conhocton, Canisteo, Tioga, Five-mile creek, and numerous others, furnish means of establishing smooth and permanent roads from almost every part of the county.

WAYNE COUNTY.

The re-examinations in Wayne county were made with a view of ascertaining some facts in relation to the iron ore which is known at different points along the whole length of the county. This ore and the associated rocks being members of the Protean group, we might have expected, what we actually find, a great variation and obscurity in the character of the rocks at different points.

From some observations in the adjoining county of Cayuga, I was led to suppose that there existed two beds of ore, and that the different localities might be in different beds. My examinations were chiefly directed to this end, knowing that three successive beds occur in this group farther east. The locality known as the Wolcott ore bed, in the eastern part of the town, is the one best known, and from which the greatest quantity of ore has been extracted. The ore at this place is about three feet thick, and where worked is covered with a thick deposite of clay, the superincumbent rock having been removed; a little distance from this place, we find a thin mass of shale covering the ore. From these circumstances, and the fact that no rocks are visible below the ore, it being but a few feet above a swamp which communicates with the lake, my examinations were difficult and not entirely satisfactory. It appears, however, that this bed is immediately below the Rochester shale, while the bed of ore at Rochester, Ontario, and other places, is separated from the same shale by forty or fifty feet of rocks, being below the Pentamerus limestone.

At Wolcott furnace, the thin bed there known and worked some time since, holds the same position, being directly beneath the Rochester shale, and above the mass of crinoidal limestone which limits the upper green shale. Were any other bed of ore below, it could not be seen at this point, as it would be below the level of the lake. The Pentamerus limestone which uniformly holds the same position, is found in a creek half a mile northeast of the furnace; and the same rock was found in digging for a salt spring on the creek below the furnace.

Four miles west of Wolcott the Pentamerus limestone is found, in a creek at Whiting's mill; the shale below is green, with a thin included mass of purple shale. No iron ore is visible at this place below the Pentamerus limestone; and above it could not be examined in consequence of a pond of water. The great accumulation of alluvial about the bays and inlets of Lake Ontario, seriously interferes in examinations of this kind.

The next point west where these rocks are visible, is at the former Shaker settlement, near Sodus point; the stream running into a small bay at the lake, has exposed the Pentamerus limestone with the shale above and below. The limestone is here twelve feet thick, and below it covers the green shale, including a thin mass of purple or chocolate colored shale. The green shale below the purple includes some wedge-shaped masses of crinoidal limestone, which have apparently taken this form in consequence of the insufficiency of the material to form a continuous stratum at the time of its deposition; the masses do not all hold the same place, appearing as if they had been infiltrated from above, some finding lower levels than others.

Above the Pentamerus limestone we find again green shale, not much dissimilar to that below. This mass is twenty or thirty feet thick, and succeeded by a mass of encrinal limestone in thin layers, which is the constant associate of the upper green shale, and separates it from the Rochester shale. Associated with this encrinal limestone, is a bed of iron ore, the thickness of which we could not ascertain at this place without excavation, which was not made. This bed corresponds in position with that at Wolcott furnace, and also with that in the eastern part of the town, from which ore is obtained for the supply of the Wolcott furnace.

The only indication of iron ore below the Pentamerus limestone, is the purple shale which has probably been colored by infiltration of iron from above. This shale occupies nearly the same position as the stratum of ore at Rochester, and the western part of Wayne county; this difference of position was probably produced while the whole mass was in a fluid state, by the iron passing through some of the strata, and forming beds upon others which were impermeable. With this view of its formation, it is not surprising that we should sometimes have one and sometimes two beds, and that their position in the rock should be variable, higher or lower in one place than another.

Farther west we have evidence in favor of the hypothesis just advanced. At Cental's mill near Sodus bay, the ore occurs in several places, and particularly on the creek above the mill. The ore at this place is intermixed with the Pentamerus limestone, and replaces the lower strata of that rock. The green shale below is but two or three feet thick, the sandstone being visible at the same place. The purple shale noticed at the two last localities, is no where to be seen. Here then we find the ore to have changed its place, and to have formed a bed below the Pentamerus limestone. At the other localities, the purple shale may be considered as the representative of the iron ore stratum; while a sufficient quantity did not pass the superincumbent strata to form a bed of the ore, some of the finer, almost soluble, particles penetrated and colored the rock. But at Cental's mill and west of it, the whole mass of ore has passed to about the position held by the purple shale at the Shakers' mill.

At the latter place, and at several localities farther west, no indications of ore could be discovered in the position of that first mentioned, or immediately below the Rochester shale. The mass at Cental's mill holds the same place as that at Ontario, Rochester, and other places where it has been observed.

I have ascertained by this examination, that the ore bed occupies two positions, one above and the other below the pentamerus limestone. The lower bed extends from Cental's mill westward to the Genesee river; and the upper bed from near Sodus bay to the eastern limit of the county. Thus far, I have not been able to ascertain the existence of the ore below the pentamerus limestone throughout this distance, though there are some indications of it in one or two places. From the situation of the rocks being near the lake level, boring would be required to ascertain the fact.

The facts relating to this ore, and the rocks of the group containing it, will be given more in detail hereafter.

In this examination, several fossils have been added to those already collected in Wayne county, and which may perhaps serve to identify these rocks hereafter. Among them is the Graptolite,* which occurs abundantly in the green shale above the pentamerus limestone, at the Shakers' mill. It is also found farther west, and one or two specimens have been seen in the same shale at Rochester, which is there characterized by the Agnostis pisiformis.

Alluvium. All the counties examined are more or less covered with alluvial deposits, which in some places merely form a thin covering of the subjacent rocks, and in others rise into hills or fill deep valleys, caused by the removal of rocky strata. The more elevated parts of the southern counties exhibit least of this deposit, while the northern ones are in many places deeply covered.

It is often difficult for the student in Geology to conceive of water flowing over the suface of a country so much elevated above the sea;

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* The Graptolite has been found in fine bituminous shale in Norway and Sweden, in rocks of the same age as those of Western New-York; those found in Wayne county nearly resemble the figure of this fossil given by Mr. Lyell, in his Elements. "These bodies are supposed by Dr. Beck, of Copenhagen, to be fossil Zoophytes, related to the family of sea pens, of which the living animals inhabit mud and slimy sediment." *See Lyell, Elements of Geology, page* 462.

and more difficult to conceive how it could transport such immense quantities of fragments. Before the doctrine was admitted that vast portions of land have suffered elevation and subsidence by gradual process, or by sudden and repeated shocks, these effects were all referred to a deluge; and the ancient alluvium has by most authors been termed diluvium. But since the experience of the last century has demonstrated that large continental areas are in some places sinking and in others rising, it is easy to comprehend that any portion of a country may have been subjected to such action at a time when it was perhaps at even a lower level than that of the sea.

It is probable that at an early period, by the elevation of the primary ranges of New-England and New-York, the interior of our country extending far to the west, became a lake or estuary. Some subsequent cause, perhaps the elevation of a portion of country in Canada, which raised all the strata of Western New-York, produced a current to the south. Other agencies may have been in operation to break up the strata in the region of Lake Ontario, which were besides of such a nature that water would soon remove a great portion of the rocks once occupying this area.

The northern parts of Ontario and Seneca counties, along the line of the Onondaga Saliferous group, are for the most part covered with deep alluvium, rising into hills of greater or less elevation. In the western part of Ontario these are very irregular in form and arrangement, and appear as if produced by the eddy of a great current flowing from north to south: hills of the same character extend westward to Genesee river. Unlike most of the alluvial hills farther east, they contain, mixed with pebbles and boulders from the north, masses from strata immediately beneath: these present rounded and smooth surfaces, showing that they have been in motion, though not far removed from the parent rock.

The upland country north of Seneca-Falls and through Wayne county, exhibits a series of parallel ridges extending N 10° E, and so uniform that a line in this direction may be seen on the very summit for a long distance. From the south the rise is very gradual to near their northern termination, which is an abrupt descent; while alternating with them may be seen the commencement of similar ridges, which continue their course for a quarter or half a mile, to be succeeded by others. Thus, in crossing the country east or west, we are constantly ascending and descending, now the high northern terminations, and again the low southern extremities. Some of these ridges are long and low, rising to a height of no more than twenty feet; the summits of others are fifty, sixty, or even a hundred feet above the general surface. They are composed of sand, which usually forms the covering of the whole, and gravel and pebbles from the rocks north; as the green sandstone of Salmon river, and the red sandstone bordering Lake Ontario.

The abrupt northern and the gradual southern slope of the ridges, together with the materials of northern origin, prove the course of the current. Their bearing here is uniform, and in the direction of Cayuga and Seneca lakes, through whose valleys the accumulated waters found a passage southward. The irregularity of these hills farther west, doubtless resulted from obstructions offered to the course of the current, by the more elevated part of the limestone terrace.

The first or lowest alluvion which has been recognized, is a dark coloured gravel,* generally containing in the middle range of counties, abundance of pebbles of dark limestone, a character however which varies with the distance from the rock; the greatest proportion of pebbles of any rock being within a limited distance south of the mass in place. The last deposit is variable in composition, but of finer materials than the first, and is always known by a reddish tinge derived from the destruction of the red shale of the Onondaga saliferous group. This colour distinguishes the soil for twenty or thirty miles south of the original rock, decreasing in intensity with the distance. The general character of this red soil is a clayey gravel, but varies from intermixture with materials from beneath and disintegrated rocks; and at some points, the removal of this soil since its deposition has exposed the dark gravel below.

The lower alluvion is less strongly marked in the southern counties; here it occurs mostly in ancient water courses. The great valleys partake largely of its character, and pebbles from the limestone and other northern rocks are found abundantly in the valley of the Chemung river, and on the southern border of the State. The valley south from Seneca lake is a well characterized example, the gravel being composed principally of northern rocks, and much worn and reduced in its progress southward. The upper alluvion of the southern counties is beyond the influence of the red shale, and does not present its distinguishing colour.

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* In the Third District Mr. Vanuxem finds below this a deposit of sand; which doubtless will also be found in the Fourth District.

Clay. This deposit is extensively distributed in the valleys and low grounds of the counties examined. The valleys between the ridges in the north part of Ontario and Seneca counties are clay, with sometimes a slight admixture of other ingredients. The destruction of northern portions of the Onondaga saliferous group has doubtless given rise to a large proportion of the clay, which from remaining longer suspended in the water was deposited upon all the other materials. Bricks made from this substance are usually of a light colour, and from the large admixture of calcareous matter are of inferior quality; though to many beds of clay this objection does not apply.

Boulders of granite, gneiss and other ancient rocks are scattered upon the surface or imbedded in the soil. Besides these are fragments of limestone and some other rocks of the district; as of the Tully limestone in the valley south of Seneca lake. One of these masses is fifty feet square and six feet thick. Numerous others are found of less dimensions, which furnish lime for the country around. These have scarcely been worn by attrition, but present the appearance of fragments just removed from the parent rock, while their nearest locality is from thirty to forty miles. Fragments of the conglomerate above the Chemung group occur in many of the valleys; these bear evidence of attrition, and have probably been derived from the tops of the neighbouring hills.

Upon the lands of the Messrs. Lawrence, in the valley on either side of Cayuga lake, are several large angular masses of rock, differing from any seen before in the district either in place or otherwise. Some of these have the colour of red sandstone, approaching to that of red jasper; others are nearly white, with veins and irregular spots of red; the rock is exceedingly hard and tough, presenting an uneven fracture. It effervesces slightly with acids. From comparison, it proves to be the same with the altered silicious limestone described by Prof. Emmons, as resting on the slate at Burlington, and doubtless equivalent to all the limestone of the western part of Massachusetts, usually termed primitive. A circumstance very remarkable is that none of these fragments have heretofore been observed, the present being more than 250 miles from the nearest locality of the rock.

Lake Marl and Tufa are very abundantly distributed over many parts of the counties examined, and are already becoming useful both for lime and agricultural purposes. Along the line of the saliferous group, these substances are abundant, arising from the decomposition of the soft gypseous marl. In the southern counties they are in more profusion than in the limestone districts, thus proving the alluvial origin of marl in these places; for if it resulted from the decomposition of limestone in place, it would be found in those regions most abundantly; which is not so. The alluvium contains a large quantity of calcareous matter, as is evidenced by the gravel being cemented by it in many places, forming a coarse conglomerate; and in others, the pebbles are covered with a deposit of the same material. The percolation of water through these immense piles of alluvium results in the solution, and afterwards the deposition of the calcareous particles; forming when deposited under water the fine pulverulent lake marl, and when exposed to the atmosphere, the porous substance called tufa.

In many places where these materials exist in abundance, limestone is brought from a great distance and burned for lime, while the marl, which is equal if not superior, remains in the bog. Thus at points distant from limestone quarries, the cost of lime greatly exceeds that for which it might be obtained from materials on the spot. I am not able to state the exact amount in loads or bushels, but am quite sure that the deposits of marl in the southern counties, are sufficient to supply the demand for lime and other purposes for an indefinite period.

There are several localities of marl in Seneca county; one of these is in the north part of Varick, about a mile from the lake shore. Near the village of Ovid, on Mr. Dunlap's farm, are several beds of marl; one of them, covering four or five acres, has been penetrated four feet, below which point it becomes sandy. It has been used both for lime and for agricultural purposes, in its present state. For the latter Mr. Dunlap considers it very beneficial; and a dressing of marl produces perceptible effects on the crops for many years afterwards. The marl at this place is a deposit from springs which have their source near the summit of the hill east.

The Cayuga marshes, embracing an area of forty thousand acres, are in many, and probably all, places underlaid by marl to the depth of several feet. This immense deposit contains far more than all known in the fourth district besides; and when the marshes are drained, as boubtless they will be eventually, this material will furnish lime and manure for an extensive district of country.

Some notice of the attempt to drain these marshes, was given in the report of last year; but so long as the lakes retain their present elevation, and are subjected to annual floods, such a plan, as the one proposed, cannot be effectual. A more feasible one would be to confine the water flowing from the two lakes to a channel of sufficient width, by walling or embankments, and to conduct all minor streams through the marshes in the same manner, or by ditches cut for the purpose, where several could be joined in one. Ditches should also be constructed along the margin of the marshes, so that all water rising from springs in the upland or other sources, could be conducted into them, the whole communicating with an outlet at a lower level than the surface of the marsh. By this means there would be no more water on the surface than that produced by rain or snow; and the present water on the marsh, with any surplus which might arise afterwards, could be removed by several windmills, working pumps placed in different parts of the marsh. This plan would doubtless be an effectual one for draining many marshes which are now entirely waste, and is possibly worthy the attention of those who wish to deepen the outlet, and thus effect a lowering of the lakes by several feet.

In the north part of Ontario county, along the range of the saliferous group are extensive deposits of marl, but none of them that I am aware have been much examined. South of the village of Bethel, along the valley of Flint creek, there is an extensive deposit of lake marl, extending for several miles in length, and from half a mile to one mile wide. The whole area is now a cedar swamp, and the fall in the stream so gradual, that there is no means of drainage except by an embankment along the stream, and ditches cut through the swamp; which would be amply repaid by the reclamation of a valuable tract of land, and an inexhaustible supply of material for lime; besides improving the healthfulness of the situation.

South of Naples, and near the head of Canandaigua lake, are several beds of marl, which have not been much explored.

In Tompkins county, in the south part of Hector, there is a very extensive bed of marl on the land of Mr. Petrie; it embraces an area of more than six acres, being of variable depth, from a few inches to more than twelve feet. At Reynoldsville are several beds, all in the same valley; from one of these two thousand bushels of lime are burned annually. On the land of Abraham Wood, six miles from Ithaca, there are several beds; and others near Newfield.

In Chemung county several beds have been noticed near Millport, and the water flowing through the soil and rising from springs, is so highly impregnated with lime, that on standing a few hours, while the carbonic acid escapes, a thin deposit of calcareous matter is observed. A deposit has been discovered on the farm of Mr. Lyon, two miles northeast of Johnson's settlement. In the town of Dix, at the Beaverdam, there is an extensive bed of marl, which has been burned for lime; it is cut into blocks, dried, and then laid in the kiln for burning. Another extensive bed occurs on the farm of Mr. Lounsbury, near Horseheads. The two last named beds contain large numbers of shells, of the genus Helix, Paludina, Planorbis, Trivolva and Cyclas.

Four miles north of Bath, at Townshend's mill, there is an extensive bed of marl and tufa; the whole is a deposit from a copious spring which supples the hydraulic power of the mill. The marl is much mixed wtih loam and clay, and is unfit for lime, except that used for agricultural purposes. The tufa could be advantageously burned for lime, in a region where this substance is transported thirty or forty miles.

Bog iron ore occurs in numerous localities, but in so small quantities as to be of little value. It is usually found at the outlet of swamps, or low grounds covered with vegetable matter, the decomposition of which furnishes carbonic acid to the iron in the soil below, thus rendering it soluble in water. To this cause is owing the whiteness of sand and gravel below mucky grounds, the iron, which was the colouring matter, having been dissolved and removed.

Water and Springs. Throughout the greater part of the district examined, water is easily obtained, and springs are abundant. In some places in the north part of Ontario and Seneca counties, where the alluvium is of great depth, some difficulty occurs in obtaining a sufficient supply. Where only the ordinary depth of alluvial occurs, springs rise to the surface at frequent intervals. Almost all the water is charged with calcareous matter; and deposits, often minute, occur in most of the streams or springs. In the southern part of the district, the streams which rise on the hills are pure, but after passing through the alluvium, they are charged with calcareous matter, or become hard water.

Hydrosulphuretted springs are numerous, particularly along the range of shales above the Seneca limestone; and also in the water lime group. Several springs of this kind were noticed in Seneca county, but none of them copious. The most remarkable one occurs in the eastern part of Manchester, on the road from Vienna to Canandaigua; the odor of the gas is perceptible at the distance of a quarter of a mile. The water issues from several points at considerable distances from each other, but all at about the same elevation in the rock. Two or three of these springs were dry at the time I visited the place, and the pebbles in the course of their outlet were covered with a deposition of sulphur. Some of the springs were flowing copiously, and one more than all the others, the quantity of water discharged being much greater than from any other spring of the kind I have ever seen, and the whole strongly impregnated with the gas. Calcareous deposits of considerable thickness are forming about the springs; these are covered with an incrustation of sulphur, as also the stones, grass and moss about the spring and along the outlet.

The spring at Canoga, from which nitrogen is emitted, has already been mentioned under Seneca county.

At Townshend's mill, four miles north of Bath, noticed as a locality of marl, there are several copious springs. These springs are the source of the inlet of Crooked Lake, and in dry seasons afford more water than from all the other streams flowing into it.

Saline efflorescences are of common occurrence on the exposed surfaces and cliffs of the upper black shale, and of the group above. These efflorescences are principally of sulphate of alumine and magnesia, but in many instances, muriate of soda or common salt occurs, and in such quantities as to produce brackish springs. These circumstances are, however, no evidence of a large quantity of the material, but only of its presence, which we might expect from the conditions under which these rocks were deposited. The largest proportion of the rock being shale, deposited from an ocean in the form of clay, which from its nature remains long suspended in water, would carry with it, during its slow deposition, some portion of the saline ingredients of that fluid. The saline matter, as the clay consolidated, became part of the rock, which now disintegrating by the action of water, the saline matter is dissolved, giving its character to springs, or appearing in efflorescences upon the exposed surfaces.

The numerous deer licks which occur in this region, derive their saline ingredients from the same source. At Jefferson, head of Seneca lake, there is a spring of this character; it is about two hundred and fifty feet above the lake. The pebbles along the stream which flows from the spring, are often in dry weather covered with particles of salt. At some distance below the spring, is a deposit of ochery iron, which impregnates the soil for some distance from the stream; this deposit has nearly disappeared, as the water from the spring is but slightly impregnated with this mineral. Saline springs are said to have been found in the margin of the large marsh or swamp at the head of Seneca lake, and Mr. Quin has obtained salt from the water by evaporation. Of these and similar indications of salt water, we may confidently say that they should encourage no expenditure in digging or boring, as the quantity of salt obtained will be too small to repay even the least labor or expense.

Carburetted hydrogen. This gas, frequently accompanied by bituminous matter, rises in many springs and streams, also in ponds and stagnant waters, as well as in places where water is not present. Surface water, indeed, has no connection with the phenomenon, any more than to indicate the presence of the gas in its passage upward, by the bubbling produced. The term carburetted hydrogen springs cannot, therefore, be used with the same propriety as sulphuretted hydrogen springs, for in the latter case the gas combines with the water, while in the former it does not. The occurrence of this gas is observed over a great extent of country, particularly in the black shale from Cayuga lake to Lake Erie. It sometimes appears to be connected with fissures or rents, whether the cause producing the latter has any influence in the production of the gas, we are unable to say. In one place on the outlet of Crooked lake, this gas is emitted in a line extending NW and SE, for the distance of several rods. The line of bubbles was traced diagonally across the canal, and from thence several rods distant across the outlet, and I was informed that at some distance SE, where a digging had been made, the gas was perceived issuing in the same line. The gas escapes in several other places in the vicinity, though there was no means of ascertaining the direction. The course here noticed is not that of the joints occurring in this rock, and may probably be connected with a fault or dislocation of the strata, as there is a slight depression of the rocks not far from this point.

In Yates county, in the town of Middlesex, one mile and a half from Rushville, this gas issues in large quantities from the soil; an excavation to considerable depth has been made, and a large volume of gas now escapes from the water, and also from a small spring near. The quantity of gas is sufficient to supply a constant flame from the entire surface of the spring. It was formerly used for warming and lighting a house near the spot, but has been for a long time neglected.

In Ontario county, near Goodwin's tavern in Bristol, there is a copious emission of this gas, and also on the opposite side of the valley. In Cheshire, five miles east of the last place, there are several localities;

jets of gas issue from small fissures in the rock, and when ignited, present a beautiful appearance. In Manchester, on the east side of Canandaigua lake, this gas escapes in much the largest quantities, and in the greatest number of places, and its occurrence is manifested more or less for considerable distance along the same range. Several years since, a practical imposter persuaded the owner of the land at this place that the escape of this gas indicated silver beneath the surface, from some decomposition or chemical change, of which this gas was liberated. The small particles and nodular aggregations of pyrites found in the rock, was also considered a proof of its existence. A boring was first commenced, which was followed by an excavation to the depth of more than fifty feet, when the work was abandoned. The earth around the openings where the gas issues, is of a dark colour, and no vegetable will grow near them, owing to the large quantity of pyrites, whose decomposition producing copperas, blackens the soil, and destroys vegetation.

Depth of Lakes. At present, we will merely state the depth of those lakes known, the various opinions regarding them being very erroneous, as we were often informed that some of these lakes were fathomless. Lake Ontario is stated to be 492 feet deep: from soundings made in Seneca lake, the greatest depth ascertained was 530 feet, and of Cayuga lake 400. Crooked lake has not been examined in the deepest part, the soundings made gave a depth of about 200 feet, and 270 feet is said to have been reached in one part. The surface of this lake is 280 feet above that of Seneca lake.

Cayuga and Seneca lakes are situated in the midst of soft shales, and from being the principal channel of the great northern current, have their beds worn much deeper than the other north and south lakes.

During the past season, I have been assisted by Mr. E. N. Hosford and Mr. E. S. Carr; and I have much pleasure in bearing testimony to the faithful manner in which both these gentlemen have discharged the duties assigned them.

Our obligations are due to the inhabitants generally, and in particular to Judge De Mott and Halsey, and Mr. Nexsen, of Seneca, to Dr. Deane and Mr. Johnson, of Ontario, and to Capt. Dakin, of the steamboat Richard Stevens, Dr. Sartwell, of Yates, Mr. Suffern, of Chemung, Mr. Leland and Mr. Pratt, of Steuben, and Mr. Duncan, of Wayne.

Of specimens illustrating the Geology and Palæontology of the Fourth District, twenty-five boxes have been deposited in the Geological rooms at the Capitol.

JAMES HALL,
State Geologist.

Note.—In the statement of the counties comprising the Fourth District, made in the report of last year, the names of Steuben, Allegany, Cattaraugus and Chautauque were omitted.

ERRATUM.

On page 6, line 22, for "Meteorological," read "Mineralogical."

GLOSSARY OF TECHNICAL TERMS

Alluvium. A recent deposit of earth, sand, gravel, peat, &c.; the term is applied to depositions which are now accumulating, as at the mouths of rivers, &c.

Alum rocks. Rocks which, by decomposition, form *alum.*

Amorphous. Bodies devoid of a regular form.

Amygdaloid. A rock more or less cellular in its structure, and at the same time abounding in cavities in the shape of an almond. It is one of the class usually called Trap rocks.

Anticlinal axis, ridge, &c. The line from which the strata of any formation dip in two directions, like the roof of a house.

Augite. A simple mineral of variable colours, passing from white through gray, green and black of different shades. It is a constituent of many volcanic and trappean rocks, limestone, granite, &c.

Basalt. A black or grayish black compact rock occurring frequently in a columnar form, as at the Giant's Causeway in Ireland. Many geologists consider it to have been formed by the fusion of augitic and feldspathic rocks under great pressure, as at the bottom of an ocean or deep sea; hence its compact structure.

Basin. Deposits lying in a hollow or trough-shaped excavation, are said to occupy basins.

Bed. A mass of mineral matter lying between the layers or strata of any rock.

Bitumen, bituminous, &c. An inflammable substance which presents itself under two forms, a solid and liquid; when in the former state, it is called *asphaltum.* In its liquid state it is like tar. Seneca oil is an example of it. Coals, slates, limestones are often bituminous.

Blende. A German name for sulphuret of zinc.

Boulders. Rocks which have been transported some distance from their original beds; they are more or less rounded by attrition and the action of the weather.

Botryoidal. Resembling in form a bunch of grapes.

Breccia. A rock or portion of a rock composed of angular fragments, cemented together by lime, iron, or some other substance.

Calcareous spar, is crystallized carbonate of lime.

Calc sinter. A deposition of porous carbonate of lime, from the waters of mineral springs.

Carbon. A simple substance, known in a pure state in the diamond only. It is one of the combustible elements in coal.

Calciferous. Bearing or containing lime.

Carbonates. Compounds formed by the union of carbonic acid and a base.

Carbonic acid. An acid gaseous compound composed of carbon and oxygen. It is incapable of supporting combustion, and deleterious to animal life. It is heavier than atmospheric air; and hence is found at the bottom of wells, cisterns or caves. Its presence may always be known by letting down a candle, by which it will be extinguished; a precaution which should always be observed previous to descending into them. A person is rendered entirely incapable of exerting himself the moment he inhales this substance, and of course cannot extricate himself when immersed in it.

Carboniferous. Coal-bearing.

Chloride. A combination of chlorine and a base, as sodium, which, in chemical language, is called a *chloride of sodium;* in common language, it is dry sea salt.

Chert. A silicious mineral resembling flint, hornstone, &c. Rocks containing it, are called *cherty.*

Chlorite. A soft greenish mineral composed of minute scales closely compacted together. It differs very little from soapstone. Rocks containing it, are said to be *chloritic.*

Clinkstone. A rock allied to basalt, which rings when struck.

Cleavage, is the separation of the lamina of rocks or simple minerals in certain constant directions. In rocks, it is not always parallel to the planes of stratification; and hence the planes of cleavage may be mistaken for those of stratification, and vice versa.

Coal measures, coal formation. Rocks containing coal.

Conformable. The arrangement of the strata of two rocks in parallel position.

Conglomerate. Masses of rounded stone, gravel and dirt, cemented together.

Cretaceous. Belonging to the chalk formation.

Crop out, and *out crop.* Emergence of a stratum or a rock from the soil, or from the adjacent strata or rocks; in other words, its appearance at the surface.

Crystal, crystalline. A geometrical solid; the latter, an assemblage of imperfectly defined crystals.

Crustacea. Animals having a thin coating or crust, like the lobster, which they shed periodically.

Delta. Alluvial lands formed near the mouths of rivers, of a triangular shape, and included between the branches of the river and the seashore. Large rivers, just before their entrance into the sea, frequently divide into several branches; this division is in consequence of the earthy matter borne down by the river to its junction with tide water, where it is deposited, forming thereby banks of sediment which rise in time above the water.

Denudation. A term used to express the removal of sedimentary matter from any area. Rocks from which any covering has been swept off by currents of water, are said to be denuded. Valleys are sometimes formed in this way; they are then called *valleys of denudation.*

Deoxidized. Deprived of oxygen.

Dicotyledonous. One of the grand divisions of the vegetable kingdom, founded on the form and structure of the seed, which, as the name expresses, has two seed lobes.

Diluvium. An accumulation of loose sand and gravel, and other materials, which some geologists suppose to have been collected or spread over a district by the action of a deluge.

Dip. The angle which a stratum or series of strata make with the plane of the horizon. The *direction of dip*, is the point of compass totowards which the strata sink or plunge, and the *angle of dip*, is the amount in degrees which the planes of the strata make with the plane of the horizon.

Dislocation. A lateral or vertical displacement of a vein, stratum or series of strata, destroying thereby the coincidence of the planes of startification in the same formation, and breaking the continuity of veins, dykes, &c.

Dolerite, one of the trap rocks, composed of feldspar and augite.

Dolomite, a magnesian carbonate of lime.

Drift, a horizontal passage into a mine.

Dunes or *downs*. Sand raised into hills and drifts by the wind.

Dykes or *dikes*. Veins of stony or rocky matter, belonging to the unstratified class, as granite, greenstone, lava, &c. which intersect the strata or cut through them, and generally approaching to verticality. It is a Scottish term for *wall*, as the dyke often projects upward above the strata in the form of a wall. The materials forming a dyke, are supposed to have been injected in a melted state from beneath, into cracks and fissures which have been formed by the drying of the earth's surface, or by convulsions of a more powerful kind, as earthquakes.

Earth's crust. The superficial parts of the earth's surface, which are accessible to observation.

Eocene. An era or period which commenced with the present order of things, applied with particular reference to the animate creation; it signifies *dawn*.

Estuary. An inlet of the sea towards the land. The extent is confined to the limits of salt water, or the area in which fresh and salt water mingle.

Exuviæ. Fossil remains of animals.

Fault. Displacement of veins, dykes and strata commencing first in their fracture and ending in their removal in some direction by which the continuity of their planes is destroyed. See *Dislocation*.

Feldspar, one of the simple minerals and next to quartz, one of the most abundant.

Feldspathic, of or belonging to feldspar.

Ferruginous, containing iron.

Fluviatile, belonging to a river.

Formation. Deposits having a common origin, or formed during the same era or period.

Fossils. Remains of plants and animals buried in the earth.

Fossiliferous. One of the grand divisions of rocks characterized by the presence of fossils.

Galena. Sulphuret of lead, or sulphur and lead; one of the common ores of lead.

Gangue. The earthy or rocky material which embraces directly the metalliferous compounds in any vein.

Garnet. A hard reddish or brownish mineral usually crystallized in the form of a solid having twelve rhombic or diamond shaped faces or planes.

Geology. A science which has for its object the investigation of the structure of the earth and the materials of which it is composed. Connected with these investigations, are deductions which may be derived legitimately from the known influence and effects of causes; these are employed as expressions of the modus operandi by which the earth has been brought to its present state.

Gneiss. A stratified primary rock, composed of quartz, feldspar and mica.

Granite. An unstratified rock, composed of quartz, feldspar and mica.

Grauwacke, graywacke. The name was originally applied to a rock composed of grains and pebbles cemented together by clay. It belongs to the transition series. The name is applied also to a group of rocks in the same series, consisting of sandstone, slates or shales, alternating with limestone, sandstone, &c. The term is rather indefinite, yet very frequently used.

Green sand. Beds of sand, sandstone, limestone and marly clays, intermixed somewhat with greenish particles, belonging to the cretaceous period, and situated beneath the true chalk.

Greenstone. A variety of trap, composed of feldspar and horneblende.

Grit. Coarse grained sandstone.

Gypsum. A mineral composed of sulphuric acid and lime.

Hornblende. A mineral, usually of a dark green colour. Crystallizing in long slender prisms.

Hornstone. A silicious translucent mineral, resembling flint, but tough and more difficult to break.

Incandescent. White hot—a degree of heat more intense than that at redness.

Iceberg. Floating masses of ice.

Ichthyosaurus. A fossil reptile, intermediate between the crocodile and fish. A fish lizard.

Induction. A consequence, conclusion, or inference, or some general principle drawn from facts or phenomena.

In-situ. Original position.

Isothermal. Equality of temperature. Zones, lines, &c. where an equality of temperature prevails are called *isothermal.*

Lacustrine, of, or belonging to, a lake.

Laminæ. Plates, sometimes used as synonymous with layers.

Landslip. Land which has slidden down an inclined plane, from its position in a bank or terrace. It is generally produced by water, which either undermines the mass of earth, or insinuates itself into it, so as to render it semi-fluid.

Line of Bearing. The point of compass to which the anticlinal ridge or line runs, or is directed. When the anticlinal ridge cannot be determined, the *line of direction* may be known by ascertaining the intersection of the planes of the strata with the plane of the horizon, that will be the line of bearing.

Lithological. The character of a rock or formation considered with reference solely to its mineral composition.

Lignite. Wood partially carbonized in the earth; it usually retains the vegetable structure. The change does not seem to have been effected by heat, but is the result of some chemical process, as the action of pure sulphuric acid in some instances, and of water in others.

Littoral, of, or belonging to, the shore.

Loam. A mixture of sand and clay.

Mural Escarpment. A rocky cliff, more or less inclined.

Mammillary. Protuberances on the surface of a mineral, which are segments of a sphere; mammæ, breasts.

Mammoth. An extinct species of animal, allied to the elephant.

Marl. Any mixture of clay and carbonate of lime, which effervesces with acids.

Matrix. Gangue. The mineral mass which is in immediate contact with the ore of a metal, both of which constitute a vein.

Manganese. A hard black mineral, resembling the dark coloured hematites. It is the oxide of manganesium, one of the metals.

Megatherium. One of the extinct fossil quadrupeds, resembling the sloth.

Mechanical origin of, Rocks composed of sand, pebbles, &c. or sedimentary rocks generally, are said to have a mechanical origin. The term is used in contradistinction to rocks having a crystalline structure, which have a chemical origin.

Mica. Sometimes called isinglass. A mineral, which may be split into numerous elastic laminæ.

Mica slate. A primary rock, composed of fine grains of quartz, and generally small scales of mica. It is eminently fissile.

Miocene. An era or period subsequent to the eocene, and characterized by a greater proportion of animals analogous to those now living. Deposits formed during this period are termed miocene strata.

Molusca. Moluscous animals. Those soft animals, whose covering is a thick shell, as oyster and clam.

Monocotyledonous. One of the grand divisions of the vegetable kingdom. It includes the grasses, palms, liliaceæ, and whose seed have only one lobe.

Mountain limestone. A series of limestone strata immediately below the coal measures.

Muriate of Soda. The chemical name for common salt, because it is composed of muriatic acid and soda.

Naphtha. A very thin volatile, inflammable liquid, of which there are springs in some volcanic districts.

New Red Sandstone. A series of sandy, argillaceous, and often calcareous strata, whose predominant colour is brick red, but contains many spots and stripes, which are gray and greenish gray. It is therefore sometimes called the variegated sandstone. It overlies the coal measures.

Nucleus. A solid central piece, around which layers of the same or other matter has collected. The kernel.

Old Red Sandstone. A rock belonging to the carboniferous group.

Oolite. Oolitic. A limestone composed of rounded grains, like the roe or eggs of fish. The name is applied to a large group of strata, characterized by peculiar fossils. Only a part have this peculiar structure.

Orthocera, *orthoceratite*. An extinct genus of animals belonging to the order Mollusca. They inhabited long strait tapering shells, divided into parts by septa or partitions. Common in the transition or Trenton Falls limestone.

Outcrop. The edges of strata, as they appear at the surface.

Outliers. The detachment of a mass of rock from the general formation to which it belongs; or it is a term applied to a mass which appears as if it was detached from the general formation, as its outcrop is at a distance from it.

Oxide. The combination of a metal, or any substance with oxygen, which is not acid.

Oxygen. One of the constituent elements of the air and water; that portion of the air which supports life and combustion.

Pachydermata. An order of animals with thick skins, as the hog, elephant, rhinoceros, mammoth, &c.

Palæontology. The science which treats of fossil remains, both animal and vegetable.

Pelagian. Belonging to a deep sea.

Petroleum. Mineral pitch; a liquid approaching the consistence of tar, of a bituminous odor, and which oozes out of a rock.

Phlegræan fields. The burnt fields; applied by the Greeks to the region around Naples, from the marks of igneous action every where visible.

Pisolite. A stone composed of rounded particles like peas, agglutinated together.

Pliocene. An era or period analogous to the present, and more recent than the *miocene.* A large proportion of the animal remains of the *pliocene* strata still exist.

Porphyry. A rock having a base whose structure is more or less compact, in which there are disseminated crystals of feldspar.

Productus. A bivalve fossil shell, concave on one side and convex on the other.

Plastic clay. One of the beds of eocene tertiary period.

Plesiosaurus A fossil extinct reptile, having a close resemblance to a lizard

Precipitate. The fine powder which separates from solutions after standing, or which are disengaged by the chemical action of bodies added to those solutions.

Pumice. A light spongy lava.

Puddingstone. Indurated or cemented masses of rounded pebbles, sand, &c.

Pyrites. A mineral composed of sulphur and iron, or sulphur and copper.

Quartz. The term universally applied to a simple mineral composed of nearly pure silex. Rock crystal is an example.

Rock. A term applied to all mineral beds or masses.

Sandstone. A rock composed of grains of sand.

Saurians. Animals belonging to the tribe of lizards.

Sacchoroidal. Resembling loaf sugar.

Schist, schistose. Slate and slaty.

Septaria. Flattened balls of stone traversed by seams of calcareous spar, or some other mineral. The outer surface has the appearance of a turtle's back; and hence they have been considered, by persons of little observation, as petrified turtles.

Shale. Generally used as synonimous with slate.

Shell Marl. The name is applied to recent fresh-water deposits, which consist of marl and numerous shells of Helices, Planorbis, &c. intermixed.

Shingle. Beaches and shores covered with water-worn pebbles and gravel.

Silex. One of the simple earths, nearly pure in rock crystal.

Silt. The finer particles of the earths suspended and transported by water.

Simple, when applied to minerals and rocks, has reference to their homogeneousness, and not to the number of elements which enter into their composition.

Stalactite. A pendant cylindrical mass of carbonate of lime, attached to the roof of a cave.

Stalagmite, is a mass of concreted limestone formed beneath the stalactite, by water dropping from it charged with carbonate of lime.

Stratum, *strata*, *stratification.* The arrangement of the layers of a rock in parallel position.

Strike. The direction in which the edge of a stratum appears at the surface.

Syenite, *sienite.* A variety of granite, in which hornblende replaces the mica.

Synclinal line, or *axis.* Where the strata dip downwards like the sides of a gutter.

Talus. A collection of rocks and stones beneath a cliff.

Tertiary. The fourth grand division of the rocky strata, composed of clays, gravels, and sometimes of consolidated beds of limestone and silicious matter; all of which are more recent than those of the three preceding divisions, as primary, transition and secondary.

Testacea. Molluscous animals having a shelly covering.

Tepid. Warm.

Thermal. Hot.

Thin out. The diminution in the thickness of strata, until they disappear.

Trap, *trappean rocks.* Ancient volcanic rocks composed of feldspar, hornblende, and hornblende and augite. Basalt, greenstone, amygdaloid and dolerite, are the most common of this class of rocks. They are sometimes called *superincumbent rocks*, because they rest or repose irregularly or indifferently on any of the other rocks. The pure hornblende rocks were formerly termed *primitive trap.*

Travertin. A deposit of carbonate of lime, more or less porous and earthy, from the water of springs; sometimes it is hard and semi-crystalline.

Tufa, *calcareous* and *silicious.* Porous or earthy deposits from springs of water, containing lime or silex.

Tuff, or *Tufa*, *Italian.* A name for a volcanic rock of an earthy texture.

Unconformable. See *Conformable.*

Veins. Openings or fissures in rocks, filled with stony or metallic matter.

Zoophites. Animals of the lowest order, as sponges, corals, &c.

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STATE OF NEW-YORK.

No. 50.

IN ASSEMBLY,

January 24, 1840.

COMMUNICATION

From the Governor, transmitting several reports relative to the Geological Survey of the State.

EXECUTIVE CHAMBER,
Albany, *January* 24, 1840.

TO THE ASSEMBLY.

Gentlemen,

I transmit herewith the several annual reports of the gentlemen engaged in the Geological Survey of the State.

WILLIAM H. SEWARD.

REPORT OF THE GEOLOGISTS.

Albany, November 15th, 1839.

To His Excellency W. H. Seward.

The Board of Geologists would respectfully call the attention of the Governor to the following subjects in connexion with the Geological Survey.

1. The provisions of Title XI. of the Revised Statutes which relate to the interest of the State in Mines—

By this act, all mines of gold and silver discovered or hereafter to be discovered within this State,—all mines of other metals discovered or hereafter to be discovered, upon any lands owned by persons not being citizens of any of the United States, and all mines of other metals discovered or hereafter to be discovered upon lands owned by a citizen of any of the United States, the ore of which, upon an average, shall contain less than two equal third parts in value of copper, tin, iron and lead, or any of those metals,—are declared to be the property of the people of this State.

It must be evident that this act operates unfavorably upon the mining interest in this State, and that it is a useless, nay perhaps odious, incumbrance upon property in the mining districts. In regard to the latter clause above cited, one or two facts deserve to be mentioned. The most valuable iron ores of the western part of the State contain on an average not more than 33⅓ per cent of pure iron. Yet these are sufficiently rich to be profitably worked. Again, ores of copper would be considered very valuable if they yielded from 20 to 30 per cent of the metal. Indeed, there are very few ores which contain two-thirds of their weight of the metal which they contain; and it seems to us that many of the mines at present wrought by individuals must fall within the provisions of this act, and in reality belong to the people of the State.

The Geologists, therefore, submit this matter to the consideration of the Governor, and respectfully request that he will make such communications to the Legislature, as will ensure the repeal of the act in question, except in so far as it relates to the lands at present owned by the State. This measure it is believed would meet with the approbation of the people, remove an important obstacle to our mining operations, and well accord with the enlightened views which characterize the present age.

2. Another subject which in the opinion of the Geologists is of considerable importance is, the collecting of copies of the various levels which have been taken by engineers employed by the State or by individuals. The information thus obtained would be of great value in determining the thickness of the various rock strata, their dip, &c. A summary of these observations may be published in the final reports of the Survey and thus a vast amount of information in regard to the topography of the State will be rendered available, which otherwise will probably be entirely lost. We cannot doubt that a request from the Governor will be sufficient for the accomplishment of this important object.

(*Note.* Mr. Ruggles, (the Canal Commissioner,) suggests that an office be established at Albany for the Canal Commissioners, where copies can be preserved of all maps, plans and drawings, of every description, made and to be made for the service of the State. This would meet the above suggestion of the Geologists if it were to include also the surveys and levels made by private companies and individuals, of which there have been a great number in various parts of the State.)

3. The Geologists would again respectfully urge the great importance of providing suitable rooms or a separate building for the collections made during the progress of the Survey. There have been obtained for the State of Mineralogical and Geological specimens alone, upwards of 400 boxes which contain several thousand specimens. These are now deposited in the most rude and unsafe manner possible, in rooms temporarily assigned to the Geologists. But it should be particularly stated at this time, that as our engagements with the State terminate in

July next, it will occasion great delay in the forthcoming works, and cause much embarrassment to us, if we are not permitted at the end of that time to unpack the boxes and arrange the specimens which have been collected. It should be added that the final reports cannot well be completed until this has been done.

It is not easy to ascertain the exact space that will be required for the display of the collections which have been made, but from an estimate which we have made, we are satisfied that it will at least be equal to that of the three rooms in the 2nd story of the old State Hall: and we are unanimously of opinion, that this is the most eligible place for the State Museum. Indeed, it is the only one of the State buildings that contains rooms sufficiently spacious for the purpose.

4. The Board would also suggest to the Governor, as matters which will soon require attention, the mode and manner in which the final reports are to be published, and the number and style of maps, geological sections and diagrams. In regard to these last, it seems to be necessary that some preliminaries should shortly be settled, that there may be no unnecessary delay from that cause in completing the whole work.

All which is respectfully submitted.

J. E. DE KAY,
LARDNER VANUXEM,
EBENEZER EMMONS,
W. W. MATHER,
T. A. CONRAD,
JAMES HALL,
LEWIS C. BECK,

LETTER

From J. E. De Kay, of the Zoological Department.

New-York, May 7, 1839.

His Excellency W. H. Seward,
Governor of the State of New-York.

SIR,

I have the honor to submit a list of such of the animals of this State, as have been collected, described and figured under the act for the Geological Survey.

I am, Sir,
With great respect,
Your obedient servant,
J. E. DE KAY.

CATALOGUE

Of the Animals belonging to the State of New-York, as far as they have been figured and described.

JANUARY 1, 1839.

MAMMALIA.

Vespertilio noveboracensis.
V. noctivagans.
V. carolinensis.
V. pruinosus.
V. subulatus.
Sorex Dekayi, (*Blackman.*)
Scalops aquaticus.
Procyon lotor.
Mephitis putorius.
Phoca cristata.
Fiber zibethicus.
Arvicola rufescens.
A. hirsutus.
Mus leucurus.
Meriones americanus.
Sciurus cinereus.
S. hudsonius.
S. niger.
S. striatus.
Pteromys volucella.
Lepus americanus.
L. virginianus.

BIRDS.

Family Vulturidæ.
Cathartes aura.

Family Falconidæ.
Aquila chrysaëtos.
Haliaëtos leucocephalus.
Pandion carolinensis.
Butætes Sancti-Johannis.
Buteo borealis.
B. hyemalis.
B. pennsylvanicus.
Nauclerus furcatus.
Falco anatum.
F. columbarius.
Cerchneis sparverius.
Accipiter fuscus.
Astuc Cooperi.
A. atricapillus.
Strigiceps uliginosus.

Family Strigidæ.
Surnia funeria.
Nyctea candida.
Scops asio.
Bubo virginianus.
Brachyotus palustris.
Ulula nebulosa.
Nyctale acadica.

Family Caprimulgidæ.
Antrostomus vociferus.
Cordeiles virginianus.

Family Hirundinidæ.
Chætura pelasgia.
Progne purpurea.
Chelidon bicolor.
Cotyle riparia.
Hirundo fulva.
H. rufa.

Family Ampelidæ.
Bombycilla garrula.
B. carolinensis.

Family Alcedinidæ.
Ceryle alcyon.

Family Trochilidæ.
Trochilus colubris.

Family Certhidæ.
Sitta carolinensis.
S. canadensis.
Certhia americana.
Thryothorus ludovicianus.
T. palustris.
Troglodytes ædon.
T. hyemalis.
T. brevirostris.

Family Orphidæ.
Sialia Wilsoni.
Turdus migratorius.
T. mustelinus.
T. solitarius.
T. minor.
T. Wilsoni.
Mimus polyglottus.
M. rufus.
M. felivox.
Anthus ludovicianus.
Regulus satrapa.
R. calendula.
Parus atricapillus.
P. bicolor.
Trichus marilandica.
T. philadelphia.
Vermivora pennsylvanica.
V. protonotarius.
V. solitaria.
V. chrysoptera.
V. peregrina.
V. rubricapilla.
Seiurus aurocapillus.
S. noveboracensis.
Sylvicola ruficapilla.
S. maculosa.
S. maritima.
S. pardalina.
S. virens.
S. Blackburniæ.
S. icterocephala.
S. castanea.
S. striata.
S. piceus.

Sylvicola parus.
S. tigrina.
S. discolor.
S. æstiva.
S. formosa.
S. canadensis.
S. cerulea.
Wilsonia minuta.
W. pusilla.
Culicivora cærulea.

Family Muscicapidæ.

Setophaga niticilla.
Tyrannula pusilla.
T. acadica.
T. virens.
T. fusca.
Tyrannus Cooperi.
Milvalus tyrannus.
Icteria viridis.
Vireo flavifrons.
V. solitarius.
V. noveboracensis.
V. gilvus.
V. olivaceus.

Family Lanidæ.

Lanius septentrionalis.

Family Corvidæ.

Perisoreus canadensis.
Cyanocorax cristatus.
Pica hudsonica.
Corvus ossifragus.
C. americanus.
C. catolotl.
Quiscalus versicolor.
Scolecophagus ferrugineus.
Sturnella ludoviciana.
Icterus baltimore.
I. spurius.
Agelaius pheniceus.
Molothrus pecoris.
Dolichonyx oryzivorus.

Family Fringillidæ.

Guiraca cerulea.
G. ludoviciana.
Struthus hyemalis.
Passarella iliaca.
Zonotrichia melodia.
Z. graminea.
Z. pennsylvanica.
Z. leucophrys.
Euspiza americana.
Coturniculus passerinus.
Ammodramus maritimus.
A. caudacutus.
Passerculus savana.
P. palustris.
Spizella canadensis.
S. socialis.
S. pusilla.
Chrysomitris tristis.
C. pinus.
Linota linaria.
Erythrospiza purpurea.
Cardinalis virginianus.
Pipilo erythropthalmus.
Spiza cyanea.
Pyranga rubra.
Plectropharus lapponicus.
P. nivalis.
Phileremos cornutus.
Corythus enucleater.
Loxia americana.
L. leucoptera.

Family Picidæ.

Dryotomus pileatus.
Picus villosus.
P. varius.
P. pubescens.
Apternus arcticus.
Melanerpes erythrocephalus.
Centurus carolinus.
Colaptes auratus.

Family Cuculidæ.

Erythrophrys erythropthalmus.
E. americanus.

Family Columbidæ.

Ectopistes migratoria.
E. carolinensis.

Family Tetraonidæ.

Ortyx virginiana, male and female.
Bonasia umbellus.
Tetrao cupido.

Family Charadridæ.

Egialites semipalmatus.
E. melodus.
E. Wilsonius.
E. vociferus.
Charadrius virginiacus.
Squatarola helvetica.
Strepsilas interpres.
Hæmatopus palliatus.

Family Psophidæ.

Grus americana, adult and young.
Egretta leuce.
E. candidissima.
E. ludoviciana.
Herodias virescens.
Ardeola exilis.
Botaurus minor.
Nycticorax americanus.
Ibis alba.
Numenius longirostris.
N. hudsonius.
N. borealis.
Hemipalama himantopus.
Heteropoda semipalmata.
Tringa maritima.
T. rufescens.
Pelidna subarquata.
P. cinclus.
P. Schinzi.
P. pectoralis.
P. islandica.
Calidris arenaria.
Actitis macularius.
Actiturus Bartramius.
Totanus flavipes.
T. chlorophygius.
T. melanoleucus.
Machetes pugnax.
Catoptrophorus semipalmatus.
Limosa fedoa.
L. hudsonica.
Macroramphus griseus.
Gallinago Wilsoni.
Rusticola minor.

Family Rallidæ.

Rallus elegans.
R. crepitans.
R. virginianus.
Ortygometra carolina.
O. noveboracensis.
Gallinula galeata.
Fulica americana.

Family Phalaropodidæ.

Phalaropus fulicarius.
Lobipes hyperboreus.
Holopodius Wilsoni.

Family Recurvirostridæ.

Recurvirostra americana.

Family Anatidæ.

Anser albifrons.
Chaulelasmus streperus.
Querquedula carolinensis.
Aix sponsa.
Fuligula rufitorques.
Caroptorhynchus labradorus.
Clangula albeola.
C. histrionica.
Erismatura rubida.

Family Pelecanidæ.

Phalacracorax dilophus.

Family Laridæ.

Rhynchops nigra.
Sterna Wilsoni.
S. arctica.
S. Dougalli.
S. argentea.
Hydrochelidon nigrum.
Thalasseus cantiacus.
T. cayanus.
Gelochelidon aranea.
Xema Sabini.
X. Bonapartii.
X. atricilla.
Larus glaucus.
L. marinus.
L. zonorhyncus.
L. canus.
L. argentatus.
Lestris pomarinus.
L. Buffoni.
L. Richardsoni.
L. dubius.

Family Procellaridæ.

Puffinus obscurus.
P. cinereus.
Thalassidroma Wilsoni.

Family Colymbidæ.

Sylbeocyclus carolinensis.
Podiceps rubricollis.
Colymbus septentrionalis.

Family Alcidæ.

Uria grylle.
Mergulus alle.
Mormon arcticus.
Utamania torda.

REPTILES.

Testudo muhlenbergii.
T. palustris.
T. clausa.
Emys punctata.
E. concentrica.
Coluber constrictor.
C. dorsalis.
C. saurita.
C. tœnia.
C. eximius.
Coluber vernalis.
C. punctatus.
Rana sylvatica.
R. fontinalis.
Scaphiophus solitarius.
Bufo americanus.
Salamandra subviolacea.
S. glutinosa.
S. punctata.

FISHES.

Perca flavescens.
Labrax mucronatus.
L. lineatus.
L. pallidus.
Centropristes nigricanus.
Pomotis vulgaris.
Prionotus carolinus.
Cottus octodecim-spinosus.
C. æneus.
Gasterosteus neoboracensis.
Otolithus raggarisregalis.
Umbrina alburnus.
Pogonias fasciatus.
Hemulon chrysopteron.
Sargus ovis.
S. aculeatus.
Pagrus argyrops.
Scomber vernalis.
Pelamys sarda.
Trichiurus lepturus.
Caranx hippos.
C. pisquetus.
Argyreosus Mitchilli.
Vomer Brownii.
Seriola zonata.
Temnodon saltator.
Rhombus triacanthus.
Gunellus mucronatus.
Zoarces labrosus.
Z. ciliatus.
Anarrhicas lupus.
Batrachus tau.
Labrus americanus.
Crenilabrus ceruleus.
Cyprinus elegans.
C. hudsonius.
Abraneis versicolor.
Catostomus oblongus.
C. pallidus.
Leuciscus chrysoleucas.
Lebias ovinus.
Fundulus flavidus.
F. fasciatus.
F. zebra.
Cyprinodon ovinus.
Esox minor.
E. reticulatus.
Bagrus rubicundus.
Pimelodus Cozzeni.
Salmo fontinalis.

Osmerus eperlanus.
Alosa mattowaca.
A. notata.
A. vernalis.
A. sapidissima.
Clupea virescens.
Chatœssus aglina.
Morrhua vulgaris.
M. eglefinus.
M. pruinosus.
Merlangus leptocephalus.
M. carbonarius.
Merluccius vulgaris.
Lota digitata.
Phycis signifer.
Platessa planus, and reversed.
P. pusilla.
Pleuronectes oblongus.
Rhombus maculatus.
R. ferrugineus.
Lumpus ceruleus.
Anguilla tenuirostris.
Diodon immaculatus.
Accipenser hudsonicus.
Spinax acanthias.
Raia ocellata.
R. diaphanes.
Petromyzon americanus.
P. maurani.

MOLLUSCA.

Loligo punctata, and ovaries.
Helix thyroidus.
H. albolabris.
H. monodon.
H. hirsuta.
H. tridentata.
H. alternata.
Limneus ———.
Melampus bidentatus.
Turbo rudis.
T. palliatus.
T. irroratus.
T. neretoides.
Scalaria lineata.
Paludina disscisa.
Natica heros.
N. duplicata.
Crepidula fornicata.
C. plana.
Nassa trivittata.
N. obsoleta.
Columbella avara.
Ranella caudata.
Fusus cinereus.
Chiton inermis.
Anomia ephippium.
Arca pexata.
Arca transversa.
Modiolus papuanus.
M. demissus.
Alasmodonta undulata.
Unio purpureus.
U. cariosus.
U. ochraceus, and var.
Cardita borealis.
Cardium Mortoni.
C. pinnatulum.
Donax fossor.
Astarte castanea.
Venus gemma.
V. mercenaria.
V. notata.
Cytherea convexa.
Petricola pholadiformis.
Mactra lateralis.
M. solidissima.
Mya arenaria.
Lyonsia hyalina.
Anatina dubia.
Solemya velum.
Pandora trilineata.
Solecurtus caribeus.
S. costatus.
Sanguinolaria fusca.

ANNULOSA.

Padoma trifida.
Piscicola mercenaria.
Hirudo niger.
Epistoma chatauque.

CRUSTACEA.

Portunus pictus.
Platycarcinus irroratus.
Lupea dicantha.
Gelasimus vocans.
Astacus Bartonii.
A. affinis.
Cymothoa triloba
C. olivacea

INSECTS.

Julus marginatus.
Holydesmus angulatus.
Lithobius spinipes.
Cicindela vulgaris.
C. purpurea.
C. rugifrons.
C. punctulata.
Carnonia pennsylvanica.
Brachinus fumans.
B. cordicollis.
Lebia atriventris.
L. viridis.
Scarites subterraneus.
Clivina bipustulata.
C. sphericollis.
Daptus incrassatus.
Staphylinus villosus.
S. immaculatus.
S. cinnamopterus.
Buprestis fasciata.
B. coronata.
B. lineata.
B. ruficollis.
Elater oculatus.
E. bilobatus.
E. vespertinus.
E. dorsalis.
E. militaris.
E. communis.
Lycus reticulatus.
Lampyris versicolor.
L. scintilans.
L. corrusca.
L. laticornis.
L. decipiens.
Telephorus marginatus.
Necrophorus americanus.
N. marginatus.
N. tomentosus.
Silpha americana.
S. marginalis.
S. inequalis.
Ateuchus lævis.
Onthophagus hecate.
Scarabeus jamaicensis.
S. maimon.
S. geminatus.
Rutela punctata.
R. lanigera.
Melolontha quercina.
M. hirsuta.
M. vespertina.
Lucanus capreolus, m. and f.
L. paralellus.
Platycerus piceus.
Passalus cornutus.
Scotinus inequalis.
Upis pennsylvanicus.
U. femoratus.
U. granarius.
Melandria striata.
Hylurgus terebrans.
Parandra brunnea.
Prionus laticollis.
P. levigatus.
P. unicolor.
Cerambyx cinctus.
C. speciosus.
C. nobilis.
C. pictus.
C. erythrocephalus.
C. violaceus.

Cerambyx varius.
C. variabilis.
C. linearis.
Lamia cingulata.
L. obsoleta.
L. tetropthalma.
L. arator.
Monochamus titillator.
Saperda calcarata.
S. tridentata.
(Desmocerus) palliata.
(D.) mandarina.
Leptura cyanipennis.
L. velutina.
L. vittata.
Crioceris trivittata.
C. collaris.
Clythra quadriguttata.
Cryptocephalus ornatus.
Chrysomela trimaculata.
C. scalaris.
C. philadelphica.
C. elegans.
C. rhois.
C. decemlineata.
Galeruca tomentosa.
G. vittata.
G. sordida.
G. notulata.
G. duodecim-punctata.
Haltica thoracica.
H. caroliniana.
H. triangularis.
Haltica collaris.
Languria mozardi.
Coccinella borealis.
C. mali.
C. novemnotata.
C. munda.
C. abbreviata.
C. decemmaculata.
C. cacti.
Papilio turnus.
P. asterias.
P. troilus.
P. philenor.
Argynnis idalea.
A. aphrodyte.
Melitea phæton.
Vanessa antiope.
V. progne.
Cynthia atalanta.
Hipparchia alope.
Limenitis ephestion.
L. arthemis.
L. misippus.
Smerinthus geminata.
Sphinx crantor.
S. satelletia.
S. azalea.
Altacus polyphemus.
A. cecropia.
A. promethea.
Saturnia io.
Arctia isabella.

ZOOPHYTES.

Ophiura rubida.
Scutella trifaria.
Tubularia divisa.
Spongia intertexta.

REPORT

Of J. E. De Kay, of the Zoological Department.

The undersigned, in compliance with the requisition of the Governor, respectfully submits the following

REPORT:

Under the provisions of the act authorizing a scientific survey of the State of New-York, he is required to furnish accurate descriptions and figures of all the species of animals found within the limits of the State. In the present state of zoological knowledge, this manifestly involves an impossibility; for to give a complete list, would require the united labors of many naturalists for a long series of years. All that was intended, we presume, was to furnish a complete account of all the known species, with as many new ones as might be discovered within the limited period assigned to the survey.

From the geographical position of our State, bounded partly on the north by the great inland seas, and touching at the other extremity the ocean; along its southern border connected with the great basin of the Mississippi, and on the north and east with the mountainous districts of the eastern States, it will readily be perceived that its animal species must be exceedingly numerous. If to this we add the consideration that the State of New-York within itself possesses those conditions of existence, arising from variety of soil, temperature and elevation, favorable to the development of organic forms, we shall find the Fauna of New-York embracing the great bulk of the Zoology of the United States. Accordingly we see animals first described as natives of the sterile plains of Missouri, or the frozen regions of the arctic circle, to be inhabitants of this State: It is not to be understood that they have not always existed here, but that their existence has but recently been observed. The geographic range of species in the United States is now, we believe, conceded to be of greater extent than in Europe; and this is attributed mainly to two causes: One is to be found in the large masses of water in the interior, equalizing the temperature to a great extent throughout the Union; the other is the existence of mountain ranges extending in a northeastern and southwesterly direction, compensating by their elevation for the difference of latitude.

The State of New-York, independent of its extent of surface, (comprising an area of 64,000 square miles,) in its latitudinal position is such that it constitutes the northern limits of many southern species, and the southern boundary of many animals usually considered as arctic or northern species. Hence we find the *Didelphis virginiana* or opossum, the *Cathartes aura* or turkey buzzard, the *Scaphiopus solitarius*, the *Hemulon chrysopteron*, and others, appearing in our State from the south; whilst the *Stemmatopus cristatus*, *Surnia nyctea*, *Somateria mollissima*, and, if I am correctly informed, even the *Cervus tarandus*, appear not far from our limits on the north. The distribution of species has been also affected by the hand of man. We refer not particularly to those species which have been domesticated, and rendered subservient to the wants of man; but to those artificial water communications, by means of which the *Cyclea ænea*, the geographic tortoise, and other inhabitants of the great lakes, have transferred their abodes to the waters of the Hudson.

There are, however, limits to the geographical distribution of animals; and the study and determination of these limits forms, at the present day, one of the most interesting objects of inquiry to the zoologist. But in order to establish this point with the requisite degree of exactness, it is scarcely necessary to observe that the species themselves must be first previously well determined; and accordingly, at the outset of our inquiries, we are met with difficulties arising from a want of a due discrimination of species. In the course of our final report, it will be perceived that many species, hitherto considered as identical with those of Europe, are treated as specifically distinct.

In cases where species have been observed north and south of the State, I have not hesitated to include them among the animals of New-York, although I have not had the good fortune to meet with them. Such, however, will undoubtedly be found; and their number, it will be perceived, is comparatively small.

I have conceived that it would add to the value of the Report, to annex short notices of all the animals described as inhabiting the United States, with reference to the source from whence they are derived. Such notices, collected from pamphlets, magazines, reviews and newspapers, all difficult of access, have greatly enhanced my labors; but it is hoped that they will be useful in abridging the researches of future naturalists.

In the general arrangement and distribution of animals, I have taken as the groundwork of my classification the *Regne Animal* of CUVIER, with such modifications as have been introduced by other naturalists. In the description of species, I have endeavored, as far as possible, to observe uniformity; and the measurements are all reduced to inches and tenths corresponding to English measure. Where a species has been described by a naturalist of authority, I have not hesitated to copy his description, with such variations as may be necessary to produce uniformity. The species itself is then carefully compared with the description; and such alterations, corrections or additions as have appeared requisite, have been incorporated in the detailed account. A notice of the habits, geographic range, and their utility or hurtfulness to man, closes the description.

CLASS I. MAMMALIA.

In this Class, I have followed almost exclusively the distribution proposed by Cuvier. The first Order, QUADRUMANA, is totally wanting in the United States; no monkey, according to Lichtenstein, having been observed beyond the twenty-ninth degree of north latitude.

ORDER CARNIVORA.

The first groupe is very natural and exceedingly numerous, not less than one hundred and fifty species having been enumerated in various parts of the globe. But nine species have as yet been detected within the limits of the United States, and five have been described as residents of this State.

Family Vespertilionidæ.

*Vespertilio noveboracensis.
*V. pruinosus.
*V. subulatus.
*Vespertilio carolinensis.
*V. noctivagans.

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* The asterisks indicate those species which have been figured for this Report.

Family Talpidæ.

This family, which a few years since only included three species, now comprises fourteen. For many of these, we are indebted to the researches of Dr. Bachman. It is still doubtful whether we have a genuine Talpa (mole) in North America.

*Condylura cristata.
*Scalops aquaticus.
*Sorex Dekayi.
*S. Forsteri.

Family Ursidæ.

Of this family, six species are found within the limits of the Union. In this State we have noticed but two species, the wolverene and badger having become extirpated. The former may, however, yet be detected; as, on the authority of Dr. Emmons, we learn that it is still found in Massachusetts.

*Ursus americanus.
*Procyon lotor.

Family Canidæ.

The species of this groupe are difficult to be distinguished by positive and well defined characters.

Canis familiaris, introduced.
*Lupus occidentalis.
*Vulpes fulvus.
V. virginianus.

Family Felidæ.

This corresponds with the old Linnean genus Felis, now subdivided into four or five genera, and embracing about forty species. In this State we have four species, including the domesticated animal.

Felis maniculata, introduced.
*F. concolor.
*Lyncus borealis.
*L. rufus.

Family Mustelidæ.

*Mustela canadensis.
*M. martes.
*Putorius noveboracensis, n. sp.
P. vison.
Putorius erminea.
*Mephitis virginiana.
Lutra canadensis.

Family Phocidæ.

Calocephalus vitulinus.
*Stemmatopus cristatus.

Family Trichecidæ.

Trichechus rosmarus, formerly an occasional visiter on our coast.
*Trichechus virginianus, fossil.

ORDER MARSUPIATA.

A groupe of animals connected by striking peculiarities. About fifty species, arranged under twelve genera, have been observed in America, New-Holland, and the Indian Archipelago. A single species only has been noticed in the United States.

Family Didelphidæ.

Didelphis virginiana.

ORDER RODENTIA.

Comprising at present about seventy species ; but many more remain to be described.

Family Musidæ.

*Sciurus leucotis, Gappar.
*S. hudsonius.
*S. striatus.
*S. niger.
*S. vulpinus.
*Pteromys volucella.
*Gerbillus americanus.
Arctomys monax.
*A. empetra.
*A. var. nigra.
*Fiber zibethicus.
Castor fiber.
Mus decumanus.
M. rattus.
M. musculus.
*M. americanus, n. sp.
*M. leucurus, n. sp.
*Arvicola riparius.
*A. rufescens, n. sp.
*A. hirsutus, n. sp.
*A. oneida, n. sp.

Family Hystricidæ.

Hystrix dorsata.

Family Leporidæ.

*Lepus americanus.
Lepus virginianus.

The Order EDENTATA has no representative in the United States.

ORDER PACHYDERMATA.

Family Equidæ.

Equus caballus, introduced.
E. asinus, introduced.
Equus major, fossil.

Family Elephantidæ.

This groupe embraces eight living and twenty-one fossil species. The living species are found only on the eastern continent.

Elephas primogenius.
Mastodon giganteum.

Family Suidæ.

Sus scrofa, introduced.

Order Ruminantia.

Family Bovidæ.

Bos taurus, introduced.
Ovis aries, introduced.

Family Cervidæ.

Cervus virginianus.
C. alces.
Cervus canadensis, extirpated?
C. tarandus?

Order Cetacea.

Family Balænidæ.

Delphinus delphis.
Phocæna melas.
*P. orca.
*Balæna mysticetus.
*Balænoptera rostrata.
*B. fossil.
Physeter macrocephalus.

CLASS II. BIRDS.

This Class has received the most attention from our naturalists, and is consequently better known than others. About four hundred and ninety species have been observed in all North America; and of these, it will be seen that more than three hundred have been observed already within the limits of the State. In this department, I have taken as the basis of my labours the geographical and comparative list of the birds of Europe and North America by C. L. Bonaparte. I have been led to this, partly from the excellence of its arrangement, and more especially as it is to form the groundwork of a General History of Birds, which it is understood will shortly be published by that eminent ornithologist. I have attempted some modifications, suggested by the excellent Synopsis of Audubon.

SUB-CLASS 1. INSESSORES.

Order 1. Accipitres.

Family Vulturidæ.

*Cathartes aura.

Family Falconidæ.

*Aquila chrysaëtos.
*Haliaëtos leucocephalus.
*Pandion carolinensis.
*Buteo Sancti-Johannis.
*B. Swainsoni.
*B. borealis.
*B. hyemalis.
*B. pennsylvanicus.
*Nauclerus furcatus.
*Falco anatum.
*F. columbarius.
*F. sparverius.
*Accipiter fuscus.
*Astur Cooperi.
*A. atricapillus.
*Strigiceps uliginosus.

Family Strigidæ.

*Surnia funerea.
*S. nyctea.
*Bubo asio.
*B. virginianus.
*Syrnium cinereum?
*Otus americanus.
*O. brachyotus.
*Ulula nebulosa.
*Nyctale acadica.
*Strix pratincola.

ORDER 2. PASSERES.

SECTION 1. AMBULATORES.

Family Caprimulgidæ.

*Caprimulgus vociferus.
*Caprimulgus virginianus.

Family Hirundinidæ.

*Chætura pelasgia.
*Hirundo purpurea.
*H. bicolor.
*H. riparia.
*Hirundo fulva.
*H. rufa.
*H. serripennis.

Family Ampelidæ.

*Bombycilla garrula.
*Bombycilla carolinensis.

Family Alcedinidæ.

*Alcedo alcyon.

Family Trochilidæ.

*Trochilus colubris.

Family Certhidæ.

*Sitta carolinensis.
*S. canadensis.
*Certhia familiaris.
*Thryothorus ludovicianus.
*T. palustris.
Troglodytes americanus?
*T. ædon.
*T. hyemalis.
*T. brevirostris.

Family Turdidæ.

*Sialia Wilsoni.
*Turdus migratorius.
*T. mustelinus.
*T. solitarius.
*T. minor.
*T. Wilsoni.
*Mimus polyglottus.
*M. rufus.
*M. carolinensis.
*Anthus rufus.
*Regulus satrapa.
*R. calendula.
*Parus atricapillus.
*P. bicolor.
*Trichas marilandica.
*T. philadelphia.
*Vermivora pennsylvanica.
*V. Swainsoni.
*V. protonotaria.
*V. solitaria.
*V. chrysoptera.
*V. peregrina.
*V. rubricapilla.
*V. celata.
*Seiurus aurocapillus.
*S. noveboracensis.
*Sylvicola coronata.
*S. ruficapilla.
*S. maculosa.
*S. maritima.
*S. pardalina.
S. pensilis?
*S. virens.
*S. Blackburnia.
*S. icterocephala.
*S. castanea.
*S. striata.
*S. pinus.
*S. montana.
*S. discolor.
*S. æstiva.
*S. formosa.
*S. canadensis.
*S. cærulea.
*Wilsonia mitrata.
*W. pusilla.
*Culicivora cærulea.

Family Muscicapidæ.

*Setophaga ruticilla.
*Tyrannula pusilla.
*T. acadica.
*T. virens.
*T. fusca.
*Tyrannus Cooperi.
*T. crinitus.
*Milvalus tyrannus.
*Icteria viridis.
*Vireo flavifrons.
*V. solitarius.
*V. noveboracensis.
*V. gilons.
V. Bartrami.
*V. olivaceus.

Family Lanidæ.

*Lanius borealis.

Family Corvidæ.

*Garrulus canadensis.
*G. cristatus.
*Pica melanoleuca.
*Corvus americanus.
*C. ossifragus.
*C. catototl.
*Quiscalus versicolor.
*Quiscalus ferrugineus.
*Sturnella ludoviciana.
*Icterus baltimore.
*I. spurius.
*Agelaius phœniceus.
*Molothrus pecoris.
*Dolichonyx oryzivora.

Family Fringillidæ.

*Coccoborus ceruleus.
*C. ludovicianus.
*Niphea hyemalis.
*Fringilla iliaca.
*Zonotrichia melodia.
*Z. graminea.
*Z. pennsylvanica.
*Z. leucophrys.
*Euspiza americana.
*Coturniculus passerinus.
C. Henslowi.
*Ammodramus maritimus.
*A. caudacutus.
*Passerculus palustris.
P. Lincolni ?
*Emberiza canadensis.
*E. socialis.
*Emberiza pusilla.
*Carduelis tristis.
*Linaria pinus.
*L. minor.
L. borealis ?
*Erythrospiza purpurea.
*Pitylus cardinalis.
*Pipilo erythropthalmus.
*Spiza cyanea.
*Pyranga rubra.
*P. æstiva.
*Plectrophanes lapponicus.
*P. nivalis.
*Alauda cornuta.
*Corythus enucleator.
*Loxia americana.
*L. leucoptera.

Section 2. Scansores.

Family Picidæ.

*Picus pileatus.
*P. villosus.
*P. varius.
*P. pubescens.
*Apternus articus.
*Melanerpes erythrocephalus.
*Centurus carolinus.
*Colaptes auratus.

Family Cuculidæ.

*Coccyzus americanus.
*Coccyzus erythropthalmus.

Section 3. Gyrantes.

Family Columbidæ.

*Ectopistes carolinensis.
*Ectopistes migratoria.

SUB-CLASS 2. GRALLATORES.

Order Gallinæ.

Family Phasianidæ.

*Meleagris gallopavo.

Family Tetraonidæ.

*Ortyx virginiana.
*Bonasia umbellus.
*Tetrao cupido.
*T. canadensis.

ORDER GRALLÆ.

Family Charadridæ.

*Egialites semipalmatus.
*E. melodus.
*E. Wilsonius.
*E. marmoratus.
*Squatarola helvetica.
*Strepsilas interpres.
*Hæmatopus palliatus.

Family Gruidæ.

*Grus americana.
*Ardea herodios.
*Egretta leuce.
*E. candidissima.
E. ludoviciana.
E. cerulea.
*Herodias virescens.
*Ardeola exilis.
*Botaurus minor.
*Nycticorax americanus.
*N. violaceus.

Family Tantalidæ.

*Ibis alba.
Ibis ordi.

Family Scolopacidæ.

*Numenius longirostris.
*N. hudsonicus.
*N. borealis.
*Hemipalama himantopus.
*H. semipalmata.
*Tringa maritima.
*T. rufescens.
*Pelidna subarquata.
*P. cinclus.
*P. Schinzi.
*P. pectoralis.
*P. pusilla.
*Calidris arenaria.
*Machetes pugnax, accidental.
*Totanus macularius.
*T. Bartramius.
*T. flavipes.
*T. chloropygius.
*T. melanoleucus.
*T. semipalmatus.
*Limosa fedoa.
*L. hudsonica.
*Macroramphus noveboracensis.
*Gallinago Wilsoni.
*Rusticola minor.

Family Rallidæ

*Rallus elegans.
*R. crepitans.
*R. virginianus.
*Ortygometra noveboracensis.
*Ortygometra carolina.
*Gallinula galeata.
*Fulica americana.

Family Phalaropidæ.

*Phalaropus fulicarius.
*Lobipes hyperboreus.
*Lobipes Wilsoni.

Family Recurvirostridæ.

*Recurvirostra americana.

ORDER ANSERES.

Family Anatidæ.

*Cygnus americanus.
*Anser hyperboreus.
*A. albifrons.
*A. canadensis.
A. Hutchinsi?
*A. brenta.
*Anas sponsa.
*A. boschas.
*A. discors.
*A. obscura.
*A. stupera.
*Marcea americana.
*Rhynchaspis clypeata.
*Querquedula carolinensis.
*Somateria mollissima.
*Somateria spectabilis.
*Oidemia perspicillata.
*O. fusca.
*O. americana.
*Fuligula valisneria.
F. erythrocephala.
*F. marila.
*F. rufitorques.
*F. labradora.
*Clangula americana.
*C. albeola.
*C. histrionica.
*Harelda glacialis.
*Erismatura rubida.

Family Mergidæ.

*Merganser castor.
*M. serrator.
*Merganser cucullatus.

Family Pelecanidæ.

*Phalacracorax carbo.
*P. dilophus.
Pelecanus americanus?
*Pelecanus fuscus.
*Sula bassana.
S. fusca.

Family Laridæ.

*Rhynchops nigra.
*Sterna Wilsoni.
*S. hirundo.
S. arctica.
*S. dougalli.
*S. argentea.
*Hydrochelidon nigrum.
*Thalasseus cantiacus.
*T. cayanus.
*Gelochelidon aranea.
*Xema Sabini.
*X. Bonapartii.
*X. atricilla.
Rissa tridactyla.
*Larus glaucus.
*L. marinus.
*L. zonorhyncus.
L. leucopterus.
L. argentatus.
*Lestris pomarinus.
*L. Richardsoni.
Procellaria glacialis?
*Puffinus obscurus.
*P. cinereus.
*Thalassidroma Wilsoni.
*T. Leachi.

Family Colymbidæ.

*Sylbeocyclus carolinensis.
*Podiceps auritus.
P. cornutus.
*P. rubricollis.
*Podiceps cristatus.
*Colymbus glacialis.
*C. septentrionalis.

Family Alcidæ.

Uria troile?
*U. grylle.
*Mergulus alle.
*Mormon arcticus.
*Utamania torda.

CLASS III. REPTILES.

ORDER 1. CHELONIA.

*Testudo clausa.
*T. muhlenbergi.
*Emys punctata.
E. centrata.
E. picta.
Emys geographica.
Chelonura serpentina.
Sphargis coriacea.
Trionyx ferox.

ORDER 2. SAURIA.

Family Iguanidæ.

Tropidolepis undulata.
Neosasaurus, fossil.
Geosaurus, fossil.

Family Scincoidæ.

Scincus quinquelineatus.

ORDER 3. OPHIDIA.

Ophisaurus ventralis.
Heterodon vulgaris.
*Coluber constricta.
*C. saurita.
*C. eximius.
*C. punctatus.
*Coluber tœnia, sirtalis *L.*
*C. dorsalis, n. sp.
*C. vernalis.
Crotalus horridus.
Trigonocephalus cupreus.

ORDER 4. BATRACHIA.

*Rana fontinalis.
R. pipicus.
*R. halecina.
R. sylvatica.
Hyla squirella.
*Scaphiopus solitarius.
*Bufo americanus.
*Salamandra punctata.
*S. glutinosa.
S. venenosa, subviolacea.
S. erythronata.
S. rubra.
Menobranchus lateralis.

CLASS IV. FISHES.

In this Class, I have taken for my guide the *Histoire des Poissons* of Cuvier and Valenciennes.

ORDER 1. SPINOUS-RAYED FISHES.

Family Percidæ.

*Perca flavescens.
P. serratogranulata.
P. gracilis.
P. acuta.
*Labrax lineatus.
*L. nigricans.
*L. pallidus.
*L. mucronatus.
Huro nigricans.
Lucioperca americana.
Lucioperca canadensis.
Serranus fascicularis.
S. acutirostris.
Merou morio.
*Centropristes nigricans.
Grystes tridens.
*Pomotis vulgaris.
Aspredodorus gibbosus.
Centrarchus æneus.
C. hexacanthus.

Family Triglidæ.

Trigla vulgaris.
Prionotus strigatus.
*P. carolinus.
P. tribulus.
Dactylopterus volitans.
*Cottus octodecimspinosus.
*C. æneus.
C. scorpius.
Hemitripterus americanus.
Aspidophorus monopterygius.
A. accipenserinus.
Aspidophorus europeus.
Hemilepidotus trachurus.
Blepsias trilobus.
Scorpena bufo.
S. porcus.
Sebastes norvegicus.
*Gasterosteus noveboracensis.
G. quadracus.
G. apeltis.
G. niger.
G. biaculeatus.

Family Scienidæ.

Sciena grisea.
Corvina oscula.
C. Richardsoni.
C. argyroleuca.
C. occellata.
Leiostomus humeralis.
*Otolithus regalis.
*Umbrina alburnus.
*Pogonias chroneis.
*P. fasciatus.
*Hemulon chrysopteron.
Pristipoma fasciatum.
Lobotes surrinamensis.

Family Sparidæ.

*Sargus ovis.
*S. aculeatus, n. sp.
S. rhomboides.
Chrysophrys aculeata.
*Pagrus argyrops.

Family Chetodonidæ.

Ephippus faber.
Ephippus gigas.

Family Scomberidæ.

*Scomber vernalis.
S. scombrus.
S. colias.
Thynnus vulgaris.
*Pelamys sarda.
Cybium maculatum.
*Trichiurus lepturus.
Xiphias gladius.
Naucratus noveboracensis.
*Elacate atlantica.
Trachinotus fuscus.
T. argenteus.
Notacanthus ———.
Caranx punctatus.
*Caranx chrysos.
*C. pisquetus.
Argyreosus vomer.
*A. Mitchilli.
*Vomer Brownii.
V. crinitus.
Seriola Boscii.
S. leiarchus.
*S. zonata.
S. cosmopolita.
*Temnodon saltator.
Peprilus longipinnis.
*P. triacanthus.
Lampris guttatus.

Family Theuthidæ.

Acanthurus phlebotomus.
Acanthurus hepatus.

Family Atherinidæ.

Atherina menidea.
A. Boscii.
Atherina mordax.

Family Mugilidæ.

Mugil petrosus.
M. Plumieri.
Mugil albula.
M. lineatus.

Family Gobidæ.

Blennius gunnellus.
Pholis ———.
Chasmodes Bosquianus.
*Gunnellus mucronatus.
*Zoarces labrosus.
*Z. fimbriatus.
*Anarrhicas lupus.

Family Lophidæ.

Lophius americanus.
Chironectes lævigatus.
Malthea nasuta.
M. notata.
Malthea vespertilio.
*Batrachus tau.
B. variegatus.

Family Labridæ.

*Labrus americanus.
*Crenilabrus ceruleus.
Cychla ænea.
Cychla minima.
C. fasciata.

Family Fistularidæ.

Fistularia serrata.

ORDER 2. SOFT-RAYED FISHES.

* ABDOMINAL.

Family Cyprinidæ.

Cyprinus carpio, introduced.
C. auratus, introduced.
*Abraneis versicolor, n. sp.
*Catostomus hudsonius.
*C. oblongus.
*C. elegans, n. sp.
*C. pallidus, n. sp.
C. teres.
Catostomus tuberculatus.
*Leuciscus chrysoleucas.
Hydrargira diaphana.
H. multifasciata.
*Fundulus flavidus, n. sp.
*F. zebra, n. sp.
*Lebias ovinus.

Family Esocidæ.

*Esox reticulatus.
*E. minor, n. sp.
E. niger.
E. estor.
Belone truncata.
Scomberesox equirostris.
Exocetus comatus.
E. furcatus.

Family Siluridæ.

Bagrus marinus.
*Pimelodus vulgaris, n. sp.
P. albidus.
Pimelodus cœnosus.
P. nebulosus.

Family Salmonidæ.

Salmo amethystus.
S. salar, accidental.
*S. fontinalis.
*Osmerus eperlanus.
Corregonus albus.
C. otsego.
C. artedi.

Family Clupidæ.

Clupea fasciata.
C. elongata.
*C. dubia, n. sp.
*Alosa sapidissima.
*A. notata, n. sp.
*Alosa menhaden.
*A. tyrannus.
*A. mattowaca.
*Chatœssus oglina.
Hiodon clodalus.

** SUBBRACHIAL.

Family Gadidæ.

*Morrhua vulgaris.
*M. pruinosus.
M. callarias.
M. æglefinus.
*Merlangus carbonarius.
*M. leptocephalus, n. sp.
M. albidus.
*Merluccius vulgaris.
*Lota digitata, n. sp.
Brosmius flavescens.
B. vulgaris.
*Phycis signifer, n. sp.
P. longipes.
P. punctatus.

Family Planidæ.

*Platessa planus.
P. dentata.
*P. pusilla, n. sp.
Hippoglossus vulgaris.
*Rhombus maculatus.
*R. ferrugineus, n. sp.
*Pleuronectes oblongus.
*Achirus mollis.

Family Discobolidæ.

*Lumpus ceruleus.
*Echeneis albicanda.
Echeneis naucrates.

*** APODAL.

Family Anguillidæ.

Anguilla vulgaris.
A. oceanica.
A. tenuirostris.
A. macrocephala.
Saccopharynx flagellen.
Ophidium barbatum.
Ammodytes ———.

ORDER 3. LOPHOBRANCHIAL FISHES.

Family Syngnathidæ.

Syngnathus fuscus.
*Hippocampus hudsonius, n. sp.
Hippocampus brevirostris.

ORDER 4. PLECTOGNATHIAL FISHES.

Family Gymnodonidæ.

Diodon rivulatus.
D. pilosus.
*D. immaculatus, n. sp.
Tetraodon turgidus.
Cephalus brevis.

Family Balistidæ.

Balistus sufflamen.
*Monocanthus broccus.
M. massachusetensis.
*Aluteres cuspicauda.
A. monoceros.
Ostracion yalei.

ORDER 5. CARTILAGINOUS FISHES.

Family Sturionidæ.

*Accipenser oxyrhynchus.

Family Squalidæ.

Scyllium litorale.
Carcharias vulpes.
Lamna punctata.
Selache maximus.
*Spinax acanthius.
Scymnus brevipinnis.
Zygena malleus.

Family Raiadæ.

Raia chautenay.
*R. ocellata.
R. batis.
*R. diaphanes.
R. Say.
Raia erinacea.
*R. Desmarestia.
R. quadriloba.
Trygon maclura.
Cephalopterus vampirus.

Family Cyclostomidæ.

*Petromyzon americanus.
*P. maurani, n. sp.
Petromyzon nigricans.
Ammocetes bicolor.

CLASS V. MOLLUSCA.

ORDER 1. CEPHALOPODA.

*Loligo punctata, n. sp.
Loligo Pealii.

ORDER 2. PTEROPODA.

*Clio borealis.

ORDER 3. GASTEROPODA.

† PULMONEA.

*Limax lineatus, n. sp.
*L. marmoratus, n. sp.
*Helix thyroidus.
*H. albolabris.
*H. tridentata.
*H. appressa.
*H. palliata.
*H. minuta.
*H. hirsuta.
*H. clausa.
*H. perspectiva.
*H. elevata.
*H. zaleta.
*H. dentifera.
*H. subglobosa.
*H. scabra.
*H. arborea.
*H. glaphyra.
*H. lineata.
*H. fallax.
*H. fraterna.
*H. diodonta.
*Helix inornata.
*H. indentata.
*H. gularis.
*H. ligera.
*H. concava.
*H. profunda.
*Pupa corticaria.
*P. exigua.
*P. pentodon.
*P. ovata.
*Succinea obliqua.
*S. putris.
*S. lineata, n. sp.
*S. ovalis.
*Auricula cornea.
A. lineata.
*A. borealis.
*Planorbis trivolvis.
*P. bicarinatus.
*P. campanulatus.
*P. parvus.
*P. exacuus.

*Planorbis armigerus.
*P. megastoma, n. sp.
*P. niger, n. sp.
*Lymnea catascopium.
*L. desidiosa.
*L. macrostoma.
*L. reticulata, n. sp.
*L. reflexa.
*L. appressa.
*L. elodes.
*Lymnea humilis.
L. pinguis.
*L. nigrescens, n. sp.
*L. modicellus.
*L. gracilis, n. sp.
*Physa heterostropha.
*P. ancillaria.
*P. fragilis, n. sp.
*P. elliptica.

†† Nudibranchiata.

Doris ———.
Tritonia Reynoldsi.
Eolis bostoniensis.
Cavolina salmonacea.
Tergipes gymnota.

††† Inferobranchiata, not observed.

†††† Tectibranchiata.

Bulla fluviatilis.
*B. insculpata.
Bulla oryza.
B. triticea.

††††† Heteropoda, not observed.

†††††† Pectinibranchiata.

Turbo obligatus.
T. irroratus.
*T. vestitus.
T. palliatus.
T. inflatus.
T. incarnatus.
T. minutus.
*T. cinereus.
T. multilineatus, n. sp.
*Lacuna fusca.
Pleurotoma bicarinata.
Turritella interrupta.
*Scalaria subulata.
*Valvata tricarinata.
*V. sincera.
*Paludina disscisa.
P. porata.
P. lustrica.
*P. heros, n. sp.
*Ampullaria paludosa.
Melania multilineata.
Laminia trifida.
L. exigua.
*Natica duplicata.
*N. heros.
*N. triseriata.
*N. pusilla.
N. consolidata.
N. immaculata.
Crepidula glauca.
*C. fornicata.
*C. plana.
*C. convexa.
Galericulum ———.
Calyptrea ———.
Sigaretus glaber.
Velutina rupicola.
Cryptostoma ———.
Marginella carnea.
Trichotropis ———.
Cancellaria leonthocyi.
Buccinum undatum.
*Nassa obsoleta.
*N. trivittata.
*Purpura lapillus.
*P. imbricata.

*Purpura bizonalis.
*Pasithea nigra.
*Ranella caudata.
*Fusus corneus.
Fusus cinereus.
F. decemcostatus.
*Fulgur canaliculatus.

††††††† SCUTIBRANCHIATA.

Fissurella greca.

†††††††† CYCLOBRANCHIATA.

*Patella alveus.
P. candida.
*P. amœna.
Ancyclus rivularis.
Chiton pectinatus.
C. fulminatus.
C. sagrinatus.

ORDER 4. ACEPHALA.

† TESTACEA.

Ostrea borealis.
O. virginica.
Pecten concentricus.
*Anomia ephippium.
*Arca pexata.
A. transversa.
A. incongrua.
Nucula semisulcata.
N. myalis.
Mytilus edulis.
M. cubitus.
M. striatus.
*Modiola papuana.
M. glandula.
*Anodonta cataracta.
A. marginata.
A. pennsylvanica.
A. plana.
A. benedictensis.
A. fragilis.
A. subcylindracea.
A. edentula.
A. Ferussaciana.
Alasmodonta rugosa.
A. undulata.
A. marginata.
A. arcuata.
Unio complanatus.
U. radiatus.
U. occidens.
Unio luteolus.
U. compressus.
U. nasutus.
*U. ochraceus.
U. cariosus.
U. novi-eboraci.
U. heterodon.
U. crassus.
U. gracilis.
Cardita borealis.
*Cardium Mortoni.
C. pinnatulum.
C. pubescens.
C. grœnlandicum.
*Donax fossor.
Cyclas similis.
C. dubia.
C. partumeia.
C. rhomboida.
Cyprina islandica.
Tellina tenera.
T. sordida.
T. lateralis.
T. versicolor.
*Venus mercenaria.
*V. notata.
*V. preopaca.
*V. inequalis.
*V. gemma.
*Astarte castanea.

Astarte daumoniensis.
Cytherea convexa.
Petricola pholadiformis.
Corbula ———.
*Mactra solidissima.
M. subtriangularis.
M. lateralis.
M. tellinoides.
M. nucleus.
Amphidesma corbuloides.
*Mya arenaria.
Lutraria ———.
Anatina pretennis.
A. papyratia.
*Solemya velum.
S. borealis.
Glycimeris siliqua.
Pandora trilineata.
Saxicava distorta.
*Solen ensis.
S. viridis.
Solecurtus costatus.
S. fragilis.
S. cariboeus.
Sanguinolaria fusca.
Pholus crispata.
P. lamellata.
Teredo navalis.

†† Nuda.

Ascidea rustica.
A. pedunculata.
A. plicata.
Ascidea ovalis.
Botryllus stellatus.
Polyclinum ———.

Order 5. Brachiopoda.

Terebratula septentrionalis.

Order 6. Cirrhopoda.

Anatifa lævis.
*Cineras vittata.
*Otion Blainvilli.
Balanus miser.
B. fistulosa.
Coronula dentulata.

CLASS VI. ARTICULATA.

This division comprises four great and distinct groupes; the Annelides, Crustacea, Arachnides and Insecta. The two latter are not in a state of sufficient forwardness to produce on this occasion. Many drawings are, however, prepared; numerous collections made; and the assistance of Dr. T. W. Harris, one of our ablest entomologists, has been obtained for this department.

I. ANNELIDES.

Order 1. Tubicolæ.

Serpula vermicularis.
S. contortuplicata.
Spicorbis ———.
Terebella ———.
Amphitrite belgica.

Order 2. Dorsibranchiatæ.

Nereis ———.
*Glycera edentata, n. sp.
Halithea aculeata.

Order 3. Abranchiatæ.

*Lumbricus terrenus.

Order 4. Asetigeræ.

*Padoma chatauque, n. sp.
Hirudo parasita.
H. lateralis.
*Piscicola mercenaria, n. sp.
Gordius aquaticus.

II. CRUSTACEA.

Order 1. Decapoda.

Platyonichus ocellatus.
*Lupea dicantha.
*L. hastata.
Panosseus Herbsti.
P. timosus.
*Platycarcinus irroratus.
Pilumnus aculeatus.
Libinia dubia.
Lissa fissirostra.
Grapsus pelagicus.
Plagusia depressa.
Ocypode albicans.
O. vocans.
Pinnothera ostreum.
Hippa emerita.
*Homarus americanus.
Astacus Bartonii.
*A. affinis.
Crangon septemspinosus.
Peneus setiferus.
Palæmon vulgaris.

Order 2. Stomapoda.

Squilla empusa.

Order 3. Amphipoda.

Gammarus fasciatus.
Amphithoe serrata.
A. punctata.
Talitrus longicornis.
Talitrus gryllus.
Unciola irrorata.
Caprella geometrica.

Order 4. Læmodipoda.

Cyamus ceti.

Order 5. Isopoda.

*Cymothoa triloba, n sp.
C. ovalis.
C. prægustator.
*C. olivacea, n. sp.
Næssa caudata.
Næssa depressa.
N. ovalis.
Idotea cœca.
I. triloba.
Asellus communis.

Stenosoma irrorata.
S. filiformis.
Philoscia vittata.
Oniscus affinis.
Porcellio spinicornis.
P. nigra.
Armadillo pillularis.

Order 6. Branchiopoda.

Branchipus ———.
Binoculus caudatus.
Argulus catastomi.
Pandarus sinuatus.
Caligus ———.

Order 7. Pæcilopoda.

Limulus polyphemus.
*Fluvicola Herricki, n. sp.

CLASS VII. RADIARY ANIMALS.

This embraces animals possessing the simplest organization, comprising star fish, sea nettles, intestinal worms, polypi, sponges, and the infusory animals.

Order Echinodermata.

Asteria spinosus.
*Ophiura rubida, n. sp.
*O. ———, n. sp.
Echinus granulatus.
Scutella pentaphora.
*S. trifaria.
Holothuria briareus.

Order Entozoa, not observed.

Order Acalepha.

Cyanea aurita.
*Beroe aurantiaca, n. sp.

Order Polypi.

Actinia marginata.
Lucernaria ———.
*Tubularia Cooperi, n. sp.
*Sertularia ampullacea, n. sp.
Cellepora ———.
Spongia racemosa.
*S. intertexta, n. sp.

All which is respectfully submitted.

J. E. DE KAY.

December 20, 1839.

COMMUNICATION

From Lewis C. Beck to the Governor, relative to the Geological Survey of the State.

New-Brunswick, N. J. May 25, 1839.

To Governor Seward:
My dear Sir,

I returned to this place yesterday, and embrace the first leisure moment to give you a brief account of my operations in connexion with the Geological Survey, since the opening of the season.

Dr. Horton and myself met, at Bergen Hill in New-Jersey, on the 18th of April, and after spending three or four days at that place, and in the vicinity of Paterson, we entered Rockland county, N. Y. through the valley of the Ramapo. My object in this preliminary examination in New-Jersey was, to collect specimens of the interesting minerals found in the green-stone or trap ranges of that State, and to ascertain their true geological associations, that we might have some guide in the subsequent examinations of similar ranges in Rockland.

After visiting all the localities of interest to us in the vicinity of Pearson's, we crossed over to the Hudson and made stops at Tappan slote, Nyack, Haverstraw, Grassy Point and Stony Point. By this means, we had a good opportunity of studying the minerals of the Palisadoes which from Bergen, in New-Jersey, to Grassy Point, form a nearly unbroken barrier along the Hudson. In our excursions, we were much gratified in finding all the minerals previously obtained in New-Jersey; by which means the catalogue of our New-York minerals will be somewhat extended. At Stony Point we found several magnesian minerals closely resembling those of Staten Island. Some of these are of so much interest to mineralogists that I doubt not this will become one of our most important localities.

Generally speaking the county of Rockland is not rich in minerals, at least so far as we can judge from what is at present known concerning it. Its great staple is the red sandstone or freestone, of which it contains an inexhaustible supply, and which in consequence of its immediate vicinity to the Hudson must be a source of great wealth. Granite for building purposes will also probably be obtained in large quantities ; and to these may be added a few quarries of limestone and ornamental marble.

Our next excursion was from Newburgh into the counties of Dutchess and Putnam. A fine and probably extensive vein of graphite or blacklead in the Fishkill mountains was the first object of interest presented to us. We subsequently devoted several days to the thorough exploration of a celebrated locality on the farm of Mr. Joseph Hustis in Philipstown, Putnam county. Here we collected specimens of beautiful serpentine, verd antique marble, asbestus, jade, tremolite, coccolite and other interesting and somewhat rare minerals. Then taking a circuit round by the way of Cold Spring, we visited the extensive and valuable deposits of magnetic iron ore in the interior of this county, such as the Denny mine, the Philips mine, &c. These veins or beds of iron ore extend for several miles traversing the highland range, but they have only here and there been wrought. The ore is usually of a good quality and is used, after mixture with some of the Orange county ores, at the Cold-Spring furnace.

Our next halt was at Carmel, the county town of Putnam, and the centre of an important mineral region. Three or four miles N. W. of this place, there are extensive beds of black marble, which is susceptible of a good polish, and only requires some easy mode of transport to the great market to bring it at once into notice. Near these beds of marble we found two old excavations for silver ore, but the minerals heretofore found in them are arsenical pyrites, iron pyrites, and small quantities of black lead. The arsenical pyrites appears to be abundant, and may turn out to be valuable for the arsenic which it contains. As the arsenical minerals are frequently associated with ores of silver, it is not surprising that these localities should have excited much attention. I intend carefully to analyze the products of these mines for the purpose of ascertaining whether they contain any thing more valuable than arsenic.

A few miles S. E. of Carmel, there occur beds of magnetic iron similar to those found in the other parts of the county. One of these, the Townsend mine, is very extensive, has been much wrought, and formerly supplied the furnace at Danbury in Connecticut; but this having ceased operations, and the mine being too far distant from Cold-Spring, it is not at present worked.

To these notices, I might add those of the quarries of limestone in the vicinity of Patterson, with their associated minerals, some of which are of interest to mineralogists. At one locality we obtained a mineral called albite, a variety of feldspar not heretofore credited to New-York, and at another we found superb specimens of epidote, not excelled by any from this country.

Putnam is one of the most, if not *the most*, mountainous county in the State. It is literally "Pelion upon Ossa." But many of the mountain slopes and vallies are in a good state of cultivation, especially in the western part; and the agriculturalist, although he has to labor hard, receives a good return. There are few men of wealth here, but the inhabitants seem generally to be in possession of the necessities, if not the comforts of life. A sufficient evidence of this is the fact, that there are only 51 inmates of the county poor-house, which, I was informed was a smaller number in proportion to the population than are found in the neighboring county.

After visiting, with an exception or two on the borders of Westchester, every locality of interest to my department in Putnam, we proceeded to Dutchess, where our time was principally occupied in examining the extensive and valuable beds of hematitic iron ore, in the towns of Fishkill and Union-Vale, and which furnish the raw material for the furnaces in this district. At the latter mine, we found a rare mineral, which I noticed there 2½ years since, in considerable abundance. It is the Gibbsite, which is associated with the iron ore, and which has heretofore been found only at Richmond and Lenox, Mass.

We have collected this season upwards of 100 suites of specimens for the State, contained in 10 boxes, which have been sent to the Hudson river from the various points at which they were obtained.

I have thus given you, according to my promise, a sketch of my operations thus far. I hope it will be interesting to you. But whether this be so or not, you will at least be apprized of what we have been doing, and have the means of answering any inquiries that may be made concerning the mineralogical department.

Our next excursion, on which we shall start in a few days, will be through the counties of Greene, Schoharie and Saratoga.—After this we proceed to Lewis and Jefferson, where I have promised to be about the latter part of June. We should be much pleased to have your company in visiting some of our interesting localities—as the lead or iron mines. We can at any time be ready to meet you on two or three days' notice.

Very respectfully,
Your obed't serv't,
LEWIS C. BECK.

New-Brunswick, N. J. June 26, 1839.

To His Excellency Gov. SEWARD:
MY DEAR SIR,

I beg leave to present to you a summary of my operations since the date of my last communication.

Dr. Horton, and myself met at Newburgh early in June, and proceeded to Catskill, where we spent two or three days in studying the mineralogy of the vicinity. The prevailing rock being slate, similar to that found every where on the banks of the Hudson, we had no great reason to expect much that was interestng in our department. At Diamond hill, a short distance from the compact part of the village, we found some rather rare varieties of calcareous spar, and tolerable specimens of rock crystal, or false diamonds, as they are sometimes called, to which indeed this locality owes its name. After finishing our work at Catskill, we continued our journey along the track of the Catskill and Canajoharie rail-road, as far as the village of Cairo. The rock excavations along this road gave us a fine opportunity of examining the geology of the region, and we were fortunate enough to add to our collection, some large and beautiful crystals of carbonate of lime, not surpassed by any hitherto obtained from this State, with the exceptions of those from Jefferson, and St. Lawrence counties

From Cairo to Schoharie Court House, the rock is generally sandstone and slate, and few objects of interest were observed by us. In the vicinity of the latter village, however, we had abundant occupation for a week, and if our time had allowed, could have advantageously added another to it.

The limestone at Schoharie, is remarkable for its singularly cavernous character. Ball's cave is one of the most extensive and interesting in the State, and several descriptions of it have been published. Besides this, there are Young's cave, Nethaway's, and several others of smaller size. The stalactites and stalagmites from some of these, and especially Ball's, are oftentimes of great size and beauty. Indeed so general and so pervading is this cavernous character in the limestone rocks of this region, that they are filled with geodes studded with crystals of great beauty, and sometimes presenting rare and interesting forms. In the immediate vicinity of the village of Schoharie, there is a rock belonging to the water-lime series, which exhibits the peculiarrity of containing nodules and masses of some rare minerals, as carbonate of strontian, sulphates of strontian and barytes, together with two compounds of those earths which have been described as new minerals. The carbonate of strontian was long mistaken for white marble, and from its quantity was proposed to be used as such, but its great specific gravity at once serves to distinguish it.

I think this region especially deserving of attention, because the minerals found here are by no means common elsewhere; while here they are so abundant as to lead one to conclude that in some way or other they owe their origin to the rock in which they are found. The determination of rocks from the minerals which are imbedded in them, or the connexion between rocks and the minerals which they contain, is a subject of high scientific and practical importance, and one to which during this season I have devoted much attention. In this respect I have seen no locality so interesting as the one in question.

We put up and forwarded to Albany from Schoharie, three or four boxes of minerals containing upwards of thirty suites. And for our success, we owe much to the polite attentions of John Gebhard, Sen. Esq. and J. Gebhard, Jun. who accompanied us to many of the localities, and furnished us with specimens of several minerals which it would have been difficult for us to have obtained.

In our excursion thus far, we passed almost in sight of the track of the contemplated rail-road from Catskill to Canajoharie, and it was natural that we should make some inquiries and form some opinions in regard to this enterprize. The route seems to be feasible enough, and those who are particularly interested in the work build their hopes of its success upon the fact that the distance from the city of New-York to the West will be shortened by some 30 or 40 miles, and that the navigation of the Hudson is free at Catskill some two or three weeks earlier and later than at Albany. I doubt whether the result will answer the sanguine expectations of its friends. The *idea* is certainly a good one, but I think it will be very difficult to divert through this channel, the great current of travel which now passes through Albany for the West. Still the increased impetus which it will give to business, the increased value of the lands adjoining the track, and the facilities which it will furnish for transporting the products of Greene, Schoharie and Montgomery, may be sufficient to warrant the expenditure, which will be required for its construction. A part of the road, say 15 or 20 miles, was nearly completed last fall, but the tremendous freshets of the winter and spring carried away several bridges, and greatly injured the track in various places. The cost of repairs will be several thousand dollars.

On leaving Schoharie we passed through Schenectady into Saratoga, our object being to obtain specimens of some rare minerals found in the vicinity of the Springs. As our stay here was limited to two or three days, we devoted ourselves chiefly to one or two localities. By means of a powerful blast we succeeded in obtaining a supply of the chrysoberyl and other accompanying minerals, for which this place has been celebrated among mineralogists. The chrysoberyl, you know, is one of the gems, of a beautiful green color, and exceeded in hardness only by the diamond and sapphire. Saratoga Springs and Haddam in Connecticut are, I believe, its only localities in the United States. Associated with this rare mineral, we found tourmaline, garnet, feldspar, mica, &c.

In a ledge of limestone, near the car-house at the Springs, we found handsome specimens of ribbon agate, and calcedony, and from a locality about four miles distant, we added to our collections specimens of oolite, similar in character to the celebrated English Bath or Portland stone of which I believe St. Paul's is built.

You are aware that my department of the Survey includes an examination of the mineral waters of the State, and what I have heretofore done in regard to this branch will be found in my second Annual Report. The specific object to which my attention is directed during the present season does not allow me time to follow up these investigations. As Dr. Steele was for many years engaged in the examination of the waters of Saratoga, I thought it would be more proper for me to take up others less known. It is my intention, however, before the completion of the Survey, to analyze with care the waters of one or two of the most important of these springs.

Our next journey, on which we start to-morrow, will be through the counties of Lewis, Jefferson, and St. Lawrence. In my next I hope to be able to give you an account of it.

With great respect,
your obed't servant,
LEWIS C. BECK.

REPORT

Of Dr. Lewis C. Beck, on the Mineralogical and Chemical Department of the Survey.

To His Excellency William H. Seward,
Governor of the State of New-York.

Sir—

I beg leave to submit the following report from the department of the Geological Survey which has been committed to my care. Permit me to state, however, that in order to comply with your request that it should be forwarded by the first of January, instead of February as heretofore, I have been obliged to omit some notices which would otherwise have been introduced. Among others I may mention those concerning the soils and mineral-manures of the State, a subject of great practical importance, and in regard to which I have collected many facts and made sundry analyses, but which I have not had time to prepare for publication.

I commenced active operations under my appointment as mineralogist and chemist to the Survey, about the first of July 1836. During that season I visited several of the most important mines of iron, lead and other metallic minerals, and the results of my observations were communicated in my first annual report. In the spring and summer of 1837, I visited several of the more important mineral springs, and before the close of the year completed the chemical analysis of many of these waters; a summary of the whole being given, with a table of our springs, in the second report. My time thus far having been almost exclusively occupied in the subjects above stated, I thought it proper to devote the principal part of the year 1838, to the examination of our other mineral productions and the collection of specimens of them for the use of the State. In addition to this, several of our most useful minerals were analyzed. The third annual report exhibits the state of this part of the work at the close of that year.

During the last year my attention has been principally, though not exclusively, confined to the same object. With the valuable assistance of Dr. Horton, who has constantly accompanied me, and whose services I cannot too highly appreciate, I have visited many of those counties which are known to possess useful or interesting mineral productions. The counties in which we have thus to a greater or lesser extent made collections, are Rockland, Orange, Putnam, Dutchess, Greene, Schoharie, Saratoga, Schenectady, Lewis, Jefferson, and St. Lawrence. Brief notices of my operations have been from time to time communicated to your Excellency. I take pleasure in stating that we almost every where met with gentlemen who were interested in the objects of the Survey and who rendered us important aid. I feel it my duty thus publicly to acknowledge my obligations to the Messrs. Pearson of Ramapo, Rockland county, Dr. Green, of Canterbury, Orange county, John Gebhard and John Gebhard, Jun. Esqs, of Schoharie, Dr. Allen, of Saratoga Springs, Mr. T. Conklin, of Martinsburgh, Lewis county, Dr. Briggs, of Ox Bow, Jefferson county, Dr. Sherman, of Rossie, and E. Dodge Esq., of Gouverneur, St. Lawrence county.

Upwards of three thousand specimens of minerals have been obtained by us for the use of the State during the past year, and these, together with the collections previously made, are ready to be arranged as soon as a proper room and cases shall have been provided for them. There are several other counties which I had hoped more fully to explore, and which would have greatly extended the collection, but as it is now understood that the active operations of the Survey will cease about the first of July next, I shall be obliged to devote myself principally to the completion of the chemical examinations which I propose to make, and to arranging the materials which have already accumulated, into the form necessary for the final report.

In this report I propose to give a brief and general view of the mineralogy of the State in reference to its geography. I shall afterwards give an outline of the mineralogy of each county so far as it is at present known; and in an appendix shall add some notices of new or interesting minerals found during the progress of the Survey.

It is an important part of the history of mineral substances to determine the manner in which they occur on the surface of the earth, their different associations and the mode in which they are distributed in different countries. These researches, although in part appertaining to Geology, when exclusively confined to simple minerals, form also an important part of descriptive mineralogy.

In examining the localities of the various mineral species and varieties we find great diversity in the appearances which they present. Minerals in a few cases constitute mountain masses; such for example as serpentine, carbonate of lime, dolomite, pyroxene, hornblende, and even magnetic iron ore. In other cases, they occur in beds, blocks or veins, such as most of the metallic minerals, and calcareous spar, in its crystallized form. Finally, other minerals are disseminated in quantities through masses of rocks, or in the rifts and cavities which they contain.

Those who have but partially studied the mineralogy of the State of New-York, cannot fail to have noticed the similarity which in this respect exists between its northern and southern portions. To such northern district belong parts of the counties of Clinton, Franklin, St. Lawrence, Jefferson, Lewis, Herkimer, Hamilton, Essex and Warren; while the southern includes parts of the counties of Orange, Rockland, Westchester, Putnam, Dutchess and Sullivan. I refer especially to the general nature of the rock formations, and to the minerals which are imbedded in them. The most interesting and important of these minerals, now known, are undoubtedly the various kinds of iron ore. Let us see how far the statement above made in regard to the similarity in the northern and southern portions of the State, is supported by the facts which we possess concerning these valuable productions.

Northern Counties.—The magnetic iron ore is almost as extensively diffused as are the mountains of granite and gneiss throughout the counties of Warren, Essex, Clinton, and Franklin. The rocks in which the ore is found in these counties, however, differ somewhat in their characters. In some parts of Essex, it is associated with a rock composed of quartz and hornblende, of a fine granular structure, but the most extensive beds in this county are associated with a granite or sienite composed almost entirely of dark coloured feldspar, containing masses of opalescent or Labrador feldspar, and in some places a small proportion of augite or pyroxene. In Clinton county the rock in which this ore is found is a granite composed of quartz and feldspar, quartz and hornblende, or feldspar and hornblende, sometimes with scales and seams of mica, forming gneiss. While in the county of Franklin the rocks contain much more hornblende, which is frequently observed in crystalline masses in the walls of the beds and among the ore.*

The ore in these counties is in almost all cases, in what are usually termed beds, or deposits of variable widths and unknown depths running parallel to the direction of the stratification, when the rock is stratified. The general direction of these beds is North-northeast and South-southwest, but when subject to local variations the course is North and South or Northeast and Southwest. Sometimes, however, this ore occurs in large masses in the rock without any regular parallelism of the sides, as is the case in Essex county. And lastly, it is sometimes disseminated in particles in the rock, apparently without any connexion with a bed or vein.

SOUTHERN COUNTIES.—In Orange county, the most abundant ore of iron is the magnetic oxide. It is generally found in that species of primitive rock so common in the highlands of this county, and often called granitic gneiss or gneissoid granite. It lies in beds and layers in this rock, and has the same line of bearing and dip. Where it exists in layers, they are from one inch to twenty feet in thickness, and in some places the layers of the ore alternate several times with those of the rock. Where the ore occurs in masses, the magnitude of the largest has never been ascertained.†

The magnetic iron ore is also found in the gneiss and hornblendic gneiss rocks in Putnam county. "They form" according to Professor Mather, "masses which by casual examination would be called beds; but after a careful investigation of the facts, I think they may be called veins. Their course is parallel to the line of bearing of the strata and they lie parallel to the layers of rock, but by a close examination, it is found that in several instances, after continuing with this parallelism for a certain distance, the ore crosses a stratum of rock and then resumes its parallelism, then crosses obliquely another and so on. In other places, where a great bed of the ore occurs at some depth, only a few small stripes of ore penetrate through the superincumbent mass to the surface, as if the rocks had been cracked asunder, and these small seams of ore had been filled up from the main mass below. The beds or veins of magnetic iron ore lie either vertical, or dipping to the E. S. E. at an angle corresponding nearly to the dip of the strata."*

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* See the Reports of Dr. Emmons and Mr. Hall.

† Dr. Horton's Report on the Geology and Mineralogy of Orange county.—Geological Reports, 1839.

From these facts there can be little doubt that the position and geological relations of this important mineral in the two extremes of the State are entirely similar.

The specular iron ore or red oxide of iron is somewhat peculiar in its associations. In New-York, this ore is chiefly, though not entirely, confined to the counties of St. Lawrence, Jefferson and Franklin, and so far as its deposits have been examined, they are found to be connected with sandstone, which is essentially composed of quartz or silica coloured by oxide of iron. This association is also exhibited in the ore itself, which frequently contains cavities filled with beautiful crystals of quartz, and which sometimes has a flinty or jaspery character. The deposits of this ore, often of vast extent are, moreover, generally, perhaps always, flanked by beds of limestone.

Nearly corresponding with the occurrence of the specular iron ore at the north, is that of the hematitic iron ore, in the southern counties of the State, which occurs in extensive beds, and usually lies near the junction of the limestone with the talcose slate formation.

Bog iron ore is almost equally abundant in different parts of the State, and does not appear to posess any peculiar geological associations. It is evidently formed by the solution and subsequent precipitation of the ores found in the older rock formations, and this precipitation has sometimes taken place at a considerable distance from its original source.

As in other countries, the ores of lead are not peculiar to any of the geological formations, being found here in almost all the series of rocks. We may cite as examples, the occurrence of galena in the hornblendic gneiss of Rossie, St. Lawrence county; in the millstone grit of the Shawangunk mountains; at the junction of the limestone and slate rocks, in Dutchess and Columbia counties; in the Trenton limestone, in Lewis county; and in the calciferous slate, in Monroe county.

In regard to the associated minerals, there are some which seem to be of constant and general occurrence, while others are in part at least influenced by the peculiar nature of the rock in which the deposit exists.

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* Geological Reports.

To the former class, belong the iron and copper pyrites and the zinc blende which almost always accompany the galena, and to the latter, the various and interesting forms of calcareous spar, fluor and crystallized quartz, which are sometimes associated with them. Of the latter, large and beautiful specimens have been found accompanying the lead ore of the Shawangunk mountains, and the same minerals occur although not so perfectly developed, in the lead veins of Dutchess and Columbia counties. But in the northern counties, calcareous spar in the most diversified and beautiful forms, constitutes the principle matrix of the ore, while fluor spar, which in all other countries is so common an associate of galena, is here of rare occurrence.

The primary rocks in the northern and southern parts of the State agree in the frequency of the beds of limestone which they contain. These beds, whether they owe their origin to the agency of water or of fire, are of a white colour, often have a highly crystalline structure and contain various imbedded minerals, which in some cases so much impair the purity of the limestone as to render it unfit for the lime-burner. Sometimes these beds are composed of the carbonates of lime and magnesia usually known by the name of dolomite. A striking feature in the mineralogy of some of the northern counties is the variety and beauty of the crystallization of calcareous spar. These crystals are generally found near the junction of the limestone with the granite or gneiss, or form the veins of spar which every where traverse them. The most interesting and beautiful specimens of this kind are to be found in the lead veins of Rossie, in the decomposed rocks at Ox-Bow and at Gouverneur. Sometimes the crystals are of enormous size and have the transparency of Iceland spar. Indeed in no part of the State are these crystalline forms so finely developed or so abundantly diffused.

In regard to the rarer minerals found in the white limestone group in the northern and southern parts of the State, there is also a similarity, while there are it is true, some points of difference. Serpentine of various shades, and often assuming a semi-crystalline form is equally common in both, together with occasional crystals of mica, blades of plumbago, &c. There are also to be found in them hornblende in all its varieties, pyroxene, scapolite, phosphate of lime, zircon, sphene, tourmaline, garnet, brucite and spinelle. The two last named minerals, however, have heretofore been found in much less abundance in the north than in the south. Orange county is particularly rich in localities of these interesting, and elsewhere rare minerals.

In the southern part of the State, and especially in the county of Putnam, there occur beds of serpentine of great extent. They appear to flank the primitive ridges, and are associated with the minerals which usually accompany this rock. In many places the serpentine is compact, susceptible of a good polish, and will undoubtedly be at some future time much used as an ornamental marble.

A fact of some importance was noticed in the examination of these beds of serpentine, and it is that the soil in their vicinity seems not to have been injuriously affected by that substance. When it is recollected that serpentine contains a large proportion of magnesia, this fact may throw some light upon the question whether that earth can be advantageously employed as a manure. On this subject I have only time to add that magnesia in the form of a carbonate, is an abundant constituent of many of the rocks in the western part of the State, and must have formed a part of the soils which originally covered them. I have found it in the proportion of from 20 to 30 per cent, in the limestone of Rochester and Lockport, in the calciferous slate of Chittenango, and in all the water limestones that I have yet examined. Now the soils in the immediate vicinity of these magnesian rocks are among the most fertile in the State.

In the counties of Jefferson and St. Lawrence, the beds of serpentine are often replaced by the so called Renssellaerite, which is probably nothing more than a mixture of soapstone and pyroxene, sometimes assuming the crystalline form of the latter mineral, and at others being compact and susceptible of a fine polish like serpentine.* This substance, principally on account of its softness and the ease with which it may be reduced to powder, has been been mistaken for gypsum and used as a fertilizer. But it need hardly be said that if the above view of its composition be correct, and if we know any thing concerning the philosophy of manures, it is idle to expect any benefit from its employment.

The serpentine of Richmond county, assumes a great variety of forms, and passes into soapstone, talc, carbonate and hydrate of magnesia, while asbestus and amianthus are also frequently found in it. Similar series of minerals are found in the serpentine rocks of Westchester and Putnam, and to a certain extent, in those of Orange. At the north, some of these associates are also to be noticed, but as yet they are not nearly so common as in the counties before mentioned. Every where, however, the close connexion between the serpentine and augite or trap, is too clearly marked to be mistaken.

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* See the appendix to this Report.

Mica Slate—This rock, although it has a limited range in the State of New-York, is characterized here as elsewhere, by the occurrence of garnet, staurotide, &c. This is well exhibited in the eastern part of Dutchess county.

Transition Argillite—This rock, which is so extensively distributed throughout the State, is exceedingly poor in minerals. It sometimes contains beds and veins of quartz striated or crystalline. Rarely the crystals are perfect and of considerable size. Perhaps the best specimens that have been found in this rock, are those obtained along the line of the Catskill and Canajoharie rail-road. The same rock frequently contains veins of fibrous and crystallized carbonate of lime, brown spar and earthy oxide of manganese. And these, together with occasional and thin seams of anthracite, and some scattered masses and crystals of iron pyrites, constitute nearly the entire mineralogy of this rock. It may be added that the mineralogical character of the greywacke is nearly the same.

Sparry Limerock—In this rock, which is among the oldest of the blue limestones, and which is characterized by its colour, and by its being traversed in all directions by narrow seams and veins of white calcareous spar: several minerals are often observed. Among these may be noticed nests of quartz crystals and brown spar; crystals of oxide of titanium and magnetic oxide of iron. Dark coloured hornstone, is also common in some of the layers of this rock; and iron pyrites, is often found in considerable abundance in it.

Calciferous Sandrock, of Eaton.—This rock, as characterized by Prof. Eaton, is chiefly composed of quartzose sand, and carbonate of lime, and is widely distributed. It is abundantly supplied with quartz of several varieties. In a decomposed rock of this kind, are found the beautiful crystals of Herkimer county, while fine specimens of drusy quartz occur in the same rock, both here and in the more northern counties of the State. Hornstone, calcedony and agate, are also found in the same stratum; as at Flint-Hill, in Montgomery county, and at Saratoga Springs. Sulphate of barytes, and anthracite in small quantities, are occasionally seen in it.

In the more recent limestones, comparatively few minerals have been found, and these seldom belong to the rarer species. As has already been observed, the Trenton limestone series contains in various localities, and especially in Lewis county, unimportant veins of galena, iron pyrites, fluor and calcareous spar.

Geodiferous Limestone.—This rock extends over some of the western counties, and has been thought to be sufficiently characterized by the numerous geodes which it contains. These geodes, though usually small, are sometimes of considerable size, and contain the sulphates of barytes and strontia, sulphate of lime, in several varieties, fluor spar in limpid and colored crystals, arragonite and pearl spar, besides the most beautiful specimens of dog-tooth spar. Sulphuret of zinc, galena and bitumen, have also been found in this rock—the latter in such quantity as to warrant the conclusion, that the peculiar odour which this rock so frequently possesses is due to the presence of that mineral substance. To these may be added, some of the ores of copper, found in exceedingly minute quantities, and sulphate of magnesia, in an efflorescent form, arising from the decomposition of the carbonate of magnesia which the rock contains.

In the *Water Limestones*, we have some interesting minerals.—Among these may be enumerated various forms of calcareous spar, and yellow sulphuret of zinc, as at Kingston, Ulster county; carbonate of strontia, and other species containing barytes and strontia, as at Schoharie; purple fluor, as at Manlius, Onondaga county, &c.

Finally, in the *Saliferous group,* or *Protean group* of Mr. Vanuxem, we have the beds of argillaceous iron ore, with the accompanying minerals, the great gypseous deposits, and the extensive formations of calcareous tufa, in all their diversified characters. These rocks also constitute the repository of the numerous and important brine springs of Onondaga and Cayuga counties.

Such is a brief outline of the mineral contents of the principal rock formations of this State. Imperfect as it is, it may serve as a guide to those who are desirous of studying our mineralogy in connexion with geology. One fact is here too obvious not to be particularly noticed; and it is that the most abundant mineral deposits are found in the primitive limestone, and generally near the junction of that rock with the granitic ranges. Whether this is owing to the agency of heat, to which the occurrence of the beds of limestone may be referred, or whether these minerals originally entered into the composition of the rocks themselves, it is not my province to inquire.

View of the Mineralogy of the different counties in the State, alphabetically arranged.

ALBANY COUNTY.

This county was examined in 1820, in reference to its Geology, Mineralogy, &c. by my brother, Dr. T. Romeyn Beck, and Professor Eaton, at the expense of the late Hon. Stephen Van Rensselaer, whose name is in some measure identified with the progress of the Natural Sciences in this State. The published report of that survey contains a catalogue of the minerals which had up to that time been found in the county. Among the most useful of these are, bog iron ore, which is found in various places: marl, which occurs in the town of Bethlehem, and is of good quality, and water limestone, found in the same town, and which might probably be used as a cement. In the city of Albany is a spring which evolves carbonic acid, and contains ingredients similar to those found in the celebrated springs of Ballston and Saratoga. This spring is further interesting from the fact that both carburetted and sulphuretted hydrogen gases are given out through the same boring, although they have their origin at different depths. There are also several sulphur springs in this county, but they are not so highly charged with gas as many others.

The following is an enumeration of the remaining minerals found in this county:

Anthracite—One or two localities where cabinet specimens may be obtained.

Bitumen—Floating on the surface of springs.

Calcareous Spar—Many localities, especially in the towns of Bethlehem and Knox. Under this head I include also tufa, stalactite, &c.

Sulphate of Lime—In needle-form crystals on limestone, in the Helderberg.

Quartz—Fibrous and crystallized, in the fissures of slate and greywacke, especially at Crystal Hill, three miles south of the city.

Ferruginous Quartz, Jasper, Coarse Agate, Basanite and Hornstone—All these varieties of quartz are occasionally found.

Alum—In the form of an efflorescence.

Iron Pyrites—Of this there are several localities in various parts of the county. To these I may add

Carbonate of Soda—Found in needle-form crystals on damp walls, in various parts of the city.

ALLEGANY COUNTY.

Very few minerals have hitherto been found in this county, and from its geological character it is not probable that the list will be much enlarged. It contains, however, several beds of bog iron ore ; and the petroleum, or oil spring, situated in the town of Cuba, is an object of considerable interest. It has been described by Prof. Silliman,* and more recently by Mr. Vanuxem.† According to the latter gentleman, lamellar hydrate of manganese associated with calcareous tufa, is found near Angelica. These are the only minerals that, have to my knowledge, been credited to this county.

BROOME COUNTY.

The mineralogy of this county is still more limited than that of the preceding. Several sulphur springs and one or two brine springs, make up the entire catalogue. A specimen of fine salt from the boring at the Triangle, furnished me by Mr. Vanuxem, is nearly free from foreign matters, and is, indeed, one of the purest and best that I have ever analyzed. I regret that I am unable to give the strength of the brine from which it was obtained.

CATTARAUGUS COUNTY.

I have not yet visited this county, nor do I know any thing of its mineral resources.

CAYUGA COUNTY.

The brine springs of this county were formerly worked to a considerable extent, and in importance they are second only to those of Onondaga. My second annual report contains a detailed account of these springs, and some suggestions in regard to the measures which should be pursued for reviving the manufacture of salt at Montezuma. In addition to these, there are here several important sulphur springs ; and a chalybeate spring occurs in the town of Sennet. Beds of gypsum also abound, and there are at least two important localities of the lenticular clay iron ore. In regard to the gypsum, it may be stated that a specimen from a bed owned by Mr. Thomson, of Springport, which was analyzed at his request, gave the following results in 100 grains, freed from water, viz.

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* Silliman's Journal, XIII. 97. † N. Y. Geological Reports, 1837.

Sulphate of lime,	71.75
Carbonate of lime,	21.65
Silica and alumina, (clay) colored by oxide of iron,	6.60

Most of the western plaster is probably similar in its composition. It usually effervesces with acids, owing to a portion of carbonate of lime which it contains. The bed from which the above specimen was procured yields about 2000 tons annually, nearly all of which is used at Springport as a manure. It is of a dark grey or nearly black colour, intermixed with thin scales of transparent selenite. On exposure to the air it disintegrates and is peculiarly interesting on account of the layers of pure sulphur, in a semicrystalline form, which pass through it. Although the occurrence of this mineral is not uncommon in the gypseous beds of the West, I have never met with such well characterized specimens as in the present instance.

To the above minerals may be added petroleum found on Cayuga Lake of the same kind as that of Allegany county, though it is less abundant. Rounded masses also occur in the slate near Auburn and elsewhere, which when broken exhibit seams of sulphate of barytes, radiated and of a snow-white colour, These masses are composed chiefly of carbonate of lime and are usually known by the name of *septaria*, in consequence of their being divided into distinct portions by partitions or *septa.*

Among the useful minerals of this county is to be reckoned water limestone, which, as well as the rock above it, contains fluor spar in small crystals, calcareous tufa is found in Sempronius, and sulphate of iron and sulphate of magnesia, are also to be included among the minerals of this county; as they are formed on some of the shales by the spontaneous decomposition of the substances which they contain.

Messrs. Vanuxem and Hall found associated with petroleum, near Ogden's Ferry, a liquid substance of the colour of phosphate of iron or Prussian blue, and another like spermaceti before the oil is fully pressed out of it. It was composed of fine scales, had a yellowish white colour, was in small irregular masses, with the appearance of having been melted. They were found in the septaria above the Tully limestone at the above locality and are supposed by Mr. Vanuxem to be new substances.*

CHAUTAUQUE COUNTY.

The most interesting object in this county connected with the mineralogical department of the survey, is the carburetted hydrogen gas, which is here evolved in such large quantities. The most remarkable localities are those at Fredonia, Westfield and Van Buren Harbor. These are commonly called gas springs, and as such, I have particularly noticed them in my report of 1838. This gas possesses an illuminating power quite equal to that of the purest coal or oil gas, and the quantity evolved is moreover so large, that it may in many places be advantageously employed. There are also often observed in the rock from which this gas issues, thin seams of a highly bituminous coal or hardened bitumen. The sandstone sometimes contains cavities filled with petroleum. Indeed this rock, especially at the Laona quarry has throughout a highly bituminous odour and all the specimens that I have tried burn with flame when thrown into the fire ;—from which it may be inferred that the whole of this bed is charged with bituminous matter.†

Equally common are springs charged with sulphuretted hydrogen, being found in various parts of the county, but especially on the shores of Lake Erie. These springs in addition to the sulphuretted hydrogen which they evolve, contain minute quantities of the sulphates of lime and of magnesia.

There are here several localities of bog iron ore, but those hitherto known are not of much importance in an economical point of view. Shell marl is abundant on the banks of Cassadaga lake, where it is put up into the form of bricks and burned into lime. Alum and cop-

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* New-York Geological Reports, 1839, p. 283.

† The following are the results of an analysis of a specimen of the Laona sandstone :—

Silica,	79.80
Oxide of iron and alumina,	4.25
Carbonate of lime,	10.50
Bituminous matter,	2.10
Moisture and loss,	3.35

peras are spontaneously formed in the town of Sheridan, a fact which is undoubtedly to be ascribed to a decomposition of iron pyrites in contact with alum earth.

CHEMUNG COUNTY.

Concerning the mineralogy of this county I have at present nothing to communicate—From what is known of its rocks, it is to be inferred that the list of its minerals is very limited.

CHENANGO COUNTY.

The only localities which I have here to notice are two or three sulphur springs, which are frequented by those who are afflicted with cutaneous diseases. They probably contain the usual ingredients of such waters, although I have not yet had an opportunity to analyze them.

CLINTON COUNTY.

The northern counties, of which this is one, are justly celebrated for their great mineral resources; but unfortunately few of them have yet been sufficiently explored to enable us to do full justice to their mineralogical history. During the year 1836, I hastily examined some of the beds of iron ore which this county contains. Notices of these, together with some further information by Mr. Hall, will be found in the first annual report of the Survey. I will only add that the magnetic iron ores of this county are among the best in the State, and that the iron obtained from them is highly esteemed. The Arnold mine deserves to be particularly noticed both on account of the quantity and quality of the ore which it yields.

Bog iron ore, has also been found on the head waters of the Saranac, which may be very advantageously employed to mix with the magnetic variety.

Marble occurs near Plattsburgh, in Chazy, and in other parts of this county. It is usually of a black colour, contains organic remains, takes a good polish, and is often quite equal in beauty to the celebrated Irish marble. According to Dr. Emmons, peat is also found here in great abundance. This at no distant day, must prove to be of great value in a district where manufacturing operations will no doubt be extensively carried on.

In the town of Beekman we notice a sulphur spring, and a carbonated spring is found in the same town. The mineralogy of this county embraces also the following species, viz.

Graphite—Four or five miles from Redford: said to be in considerable abundance.

Crystallized quartz—Arnold and Palmer ore beds, &c.

Feldspar and mica—With the preceding.

Pyroxene—Several varieties.

Iron Pyrites—Often associated with the magnetic iron ore.

Sulphuret of molybdenum.

I cannot doubt that this catalogue will hereafter be greatly extended.

COLUMBIA COUNTY.

This county possesses considerable interest to the mineralogist. It has been perhaps quite as thoroughly explored as any other, and the number of its minerals is greater than that of three-fourths of the counties in the State.

Among those minerals which are considered the most useful, may be enumerated the hematitic and bog iron ores, important deposites of which exist in various parts of this county. Of galena, or the common ore of lead, there are also several localities, the most noted of which is that in the town of Ancram. At this place, the ore is found near the junction of the slate with the limestone, and from the favorable appearances which were presented, capitalists were induced to incur large expenditures in mining operations. But the expectations of those who were interested in this mine have, I believe, been sadly disappointed. The ore occurs in strings and bunches rather than in veins, and mining is therefore attended with much hazard.

The variety of oxide of manganese, called wad, and which when pure, is used in the manufacture of bleaching powder, has been found in various parts of this county. In the second annual report of the survey, Mr. Mather notices several localities where the quantity seems to be abundant. The specimens which I analyzed contain from 50 to 68 per cent of oxide of manganese, and are probably pure enough for most of the uses to which this substance is applied. This point, however, as well as the real value of different specimens can be determined only by experiments conducted on a large scale, and by a careful comparison of the results with those afforded by the varieties of this mineral now in use.

Peat and marl are to be included among the useful products of this county. Of these, there are several important localities which cannot fail to be of great value. According to Mr. Mather, there exist beds of marble in the towns of Hillsdale and Copake, equal to those of Stockbridge and Egremont, in Massachusetts.*

Columbia county contains several sulphur and chalybeate springs, and one which possesses great interest in consequence of its evolving nitrogen gas, viz: the Lebanon springs, which are too well known to need any further notice.

The following minerals have also been found in this county, viz.

Graphite—Several unimportant localities.

Sulphate of barytes—Associated with the lead ore at Ancram.

Calcareous tufa—Several localities.

Brown spar—Several localities, in the slate rock.

Sulphate of lime—has been found in small quantities at Hudson.

Crystallized quartz, fetid and milky quartz, and basanite—Of each of these there are several localities.

Alum—In the form of efflorescence.

Epidote—Is credited to this county, but I have not met with it.

Iron pyrites—Several localities.

Sulphuret of copper, pyritous copper, and green carbonate of copper—All found in company with lead ore.

CORTLAND COUNTY.

The only notices to be introduced here are those of iron ore, which occurs in small quantities; one or two sulphur springs; a weak brine spring, and some beds of marl. Mr. Vanuxem states that the marl near the Four Corners is put into the form of bricks, dried and burned into lime.†

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* N. Y. Geological Reports, 1838, p. 171.

† N. Y. Geological Reports, 1837, p. 192.

DELAWARE COUNTY.

This county has heretofore proved to be still less rich in minerals than the preceding. A brine-spring was discovered near Delhi in 1833, and a boring of considerable depth was made through the rock. I have not ascertained the strength of the water they obtained. According to Mr. Mather there are some deposites of bog-iron ore in this county which may hereafter prove to be valuable. He also states that copper ore is very extensively diffused although in small quantities.* There are moreover several mineral springs.

DUTCHESS COUNTY.

The mineral productions of this county are quite similar to those of Columbia, to which it is contiguous. There is no part of the State in which iron ore is more abundant or more advantageously wrought. This ore is almost always of the variety called hematite, which is sufficiently rich, and yields iron of an excellent quality. Beds of it have been opened in the towns of Fishkill, Unionvale, Dover and Amenia, from which several furnaces are contantly supplied. But from appearances which are presented in various places, there can be no doubt that new beds will hereafter be discovered, and that the supply of ore will be equal to any demand that may be created.

There exist here, as in Columbia county, several localities of wad or earthy oxide of manganese ; some of these may hereafter turn out to be valuable.

The marble quarries of Dutchess are numerous, and the quantity of this useful material is entirely inexhaustable. The beds are similar in their character to those of Stockbridge and Egremont, and are found in the towns of North-East, Dover, Pawlings, Beekman and Fishkill. But the only ones which are extensively wrought at present are those of Dover, a circumstance chiefly to be ascribed to the land transport which is required to bring the marble to market.

The Dutchess county marble varies somewhat in its characters. It is almost always dolomitic, or composed of the carbonates of lime and magnesia in variable proportions ; sometimes it is large grained and quite compact ; at others it is fine grained and so loose in its texture as to be unfit for a building material. A specimen of this marble from

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* Letter to his Excellency Governor Seward, published in the newspapers in September, 1839.

Dover, which was of a snow-white colour, had a granular texture, and was as friable as loaf sugar, gave upon analysis, the following results in 100 parts, viz :

Carbonate of lime,	60.50
Carbonate of magnesia,	39.50

There are in this county several localities of galena, but they have not been thought of sufficient importance to lead to much expenditure in exploring them. The veins of ore are similar to those found in Columbia county, and it is not probable that they will ever be of much account in an economical point of view.

Peat and marl are found here in abundance. The latter must be of great value in a region where agriculture is a pursuit of so much importance as it is in Dutchess.

To this list of useful minerals, must be added another which is rarely met with in quantities large enough for profitable exploration. I refer to graphite, or black-lead, as it is commonly called. This substance has been found in considerable abundance in a mine which has been opened on the farm of Mr. Peter Dewint, two and a half miles southeast of Fishkill landing. Several tons have been obtained here and sent to market. It occurs in a vein in the granite, several inches wide at the surface, and increasing gradually in descending to two or three feet. About 40 or 50 feet of this vein are exposed, and there appears to be every indication that there is an abundant supply of the mineral. The specimens which we obtained here are both foliated and granular, and are of sufficient purity for nearly all the purposes to which graphite is applied. There is said to be another vein of a similar kind at Fishkill Hooks.

Of mineral springs we only notice one from which sulphuretted hydrogen is evolved, and one from which arises an inflammable gas, said to be carburetted hydrogen.

The following minerals are also found in this county, viz :

Calcareous spar, including stalactite, &c.

Crystallized quartz.

Asbestus—Associated with dolomite.

Gibbsite—This very rare mineral was found in considerable abundance, associated with hematite, in the town of Union-Vale, by Dr. Horton and myself.

Garnet, precious and common—In mica slate, near the Foss ore bed, and at Stone Church, Dover.

Staurotide—Associated with the garnets at the former locality.

Feldspar, epidote, tourmaline.

Specular iron ore—In small crystals at the Clove ore bed.

Iron pyrites, copper pyrites, sulphuret of copper, and carbonate of copper—All found occasionally associated with galena.

ERIE COUNTY.

This county, in other respects so highly favored, cannot boast much of its mineral wealth. The thin layers of coal which are sometimes found in it, as well as in several other western counties, would at first view seem to favor the idea that this valuable mineral exists in abundance. But this has been ascertained to be incorrect and it is only in a complete account of the mineralogy of the State that these occurrences deserve to be noticed. Perhaps the most abundant mineral in this county is iron pyrites, which occurs in great abundance at Eighteen Mile creek and elsewhere. Unfortunately this substance is of little value, and the only interest which attends its occurrence here, arises from the fact that various salts are formed by its spontaneous decomposition and subsequent union with other constituents of the rocks in which it occurs. Thus we have sulphate of iron or copperas, sulphate of magnesia and alum as the result of these changes.

Minute quantities of some of the ores of copper have been observed by Mr. Vanuxem in the rocks near Black-Rock, as gray copper, copper pyrites and the green carbonate of copper.

A large deposit of calcareous tufa is found at Ellicott's Mills, and the formation of it is constantly going on. This is another of those curious natural operations of which we have many examples in various parts of the State. In my second annual report I have attempted a summary of the principal localities of this kind in the State under the general head of Petrifying Springs.

Water limestone has been found on Grand Island. A specimen, which I received from Mr. Hall, has a dark drab colour, the usual conchoidal fracture and has the following composition in 100 parts, viz :

Insoluble matters, (silica and alumina,).......	12.25
Bituminous matter,.......................	0.25
Carbonate of lime,.......................	51.00
Carbonate of magnesia,...................	36.50

It is therefore similar in its composition to the water limestones found in other parts of the State.*

There is a sulphur spring of some character four miles from Buffalo, and a spring on Grand Island is interesting in consequence of its containing free sulphuric acid although in a very dilute State. Petroleum is also found floating on the surface of many springs, but it is by no means abundant.

It remains only for me to notice under this county those septaria or rolled masses of impure limestone to which I have previously referred. These as they are found here are entirely similar to those which occur in Chautauque county. They commonly exhibit on the outside, sutures which pass in various directions, and are generally composed of minerals different from those in other parts of the mass. They are either folia or blades of sulphate of barytes, or crystals of calcareous spar or brown spar, with occasionally some anhydrite.†

ESSEX COUNTY.

Unlike the preceding, this county possesses immense mineral resources. Enough is already known to warrant this assertion, but many years must elapse before a correct estimate can be formed in regard to their real extent and value. To say that there are here numerous beds of magnetic iron ore, would scarcely convey a true idea of the enormous deposits of that mineral which are found in various parts of the county. Some notices of these have already been published in the reports of Dr. Emmons and Mr. Hall. The ore is every where of sufficient purity for the manufacturer, and if only a small proportion of it

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* Another specimen of water limestone from Williamsville in this county, contains

Silica and alumina,................................	18.45
Bituminous matter,................................	1.30
Carbonate of lime,................................	46.25
Carbonate of magnesia,............................	34.00

† The occurrence of this mineral in the septaria is given on the authority of Mr. Vanuxem. New-York Geological Reports 1837, p. 191.

can be wrought, Essex must become one of the most thriving counties in the State.*

In addition to these deposits of magnetic iron ore, there are also beds of the specular ore which are used at Crown Point, &c.

Several localities of graphite occur in this county. One of these is situated near Ticonderoga and has long been celebrated for the excellent quality of the mineral which it yields. As early as 1822, two or three tons were annually obtained here and sent to market. From a statement of property cleared at Whitehall, from 1823 to 1834, it appears that there were shipped of black lead in 1829, 10,000 lbs; in 1834, 22,000 lbs. This amount was probably obtained from the mine now noticed. Besides this, there are several other localities of this mineral, but I have not been able to learn any thing of their value.

Among the useful minerals of Essex may be mentioned marble of the verd antique variety, a valuable bed of which is found near Cedar Point. It appears to be free from cracks and flaws, and is equal in beauty to any of the marbles of this kind.

To the mineralogist, this county presents one of the most interesting fields of research. Although it has been but partially explored, many rare and beautiful minerals have already been discovered. The following is a list of these:

Calcareous spar—Several forms and several localities.

Crystallized phosphate of lime.

Fibrous phosphate of lime—*Eupyrchroite* of Dr. Emmons, (see appendix) Crown Point.

Sulphate of lime—In solution in springs.

Sulphate of magnesia—In similar situations with the preceding.

Rose quartz, together with some other varieties of this mineral.

Tabular spar—Town of Lewis.

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* I have recently analyzed a specimen of magnetic iron ore which I received from A. McIntyre, Esq. It is from the great bed at the head of the mill pond, in the town of Newcomb. It is black, attracted by the magnet and has feeble polarity. The following is its composition in 100 parts—

Protoxide and peroxide of iron,	92.15
Earthy matters, principally silica,	7.85

Proportion of metallic iron about 66, in 100 of the ore.

Serpentine, precious and common—Several localities.

Pyroxene—In almost all its varieties.

Hornblende, actynolite, tremolite—Several localities.

Hypersthene—Abundant in various parts of the county, according to Dr. Emmons.

Spinelle—Rare.

Idocrase—Two localities.

Garnet, common and manganesian.

Colophonite—Town of Lewis.

Seapolite.

Feldspar, adularia and Labradorite—Abundant.

Mica—Several localities.

Chiltonite, a supposed new mineral, described by Dr. Emmons—Westport.

Sulphuret of iron—Cedar Point.

Iron pyrites—Often associated with magnetic iron ore, &c.
Arsenical pyrites—Town of Lewis.

Sphene—Several localities.

Yenite—Found in this county, according to Dr. Emmons.

FRANKLIN COUNTY.

This county, like the preceding, is at present chiefly celebrated for the abundance of its deposits of iron ore. Most of the varieties of this important substance are found here in large quantities, and of a good degree of purity; as for example, the magnetic iron ore, specular iron ore and bog iron ore. The latter, however, is less extensively wrought than the others. At Westville, a bed of this ore has supplied a forge-fire for twenty-five years.*

Deposits of calcareous tufa occur here in considerable abundance. At Chateaugay it is burned into lime of an excellent quality. Marble, of the white primitive kind, also abounds here, although it has not yet been turned to much account.

Among the objects of interest in this county, are the springs situated about a mile and a half east of Chateaugay Corners. These are said to flow only for six months in the year, viz. from April to the latter part of September. During the rest of the year they are entirely dry. Bubbles of nitrogen gas rise from the bottom of these springs, as at Lebanon; a circumstance still more remarkable in this case, as the waters are quite cold.

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* **Hall, New-York Geological Reports, 1837, p. 139.**

It is scarcely necessary to observe, that the minerals which are usually found in primary regions occur in this county.

Thus we have quartz, feldspar, mica, and hypersthene is said also to be a common mineral. It must be confessed, however, that I am not yet prepared to do justice to the mineral resources of this county.

FULTON COUNTY.

I regret that it is not in my power to say any thing at present concerning the mineralogy of this county.

GENESEE COUNTY.

This is one of the rich agricultural counties of Western New-York which is perhaps less dependent upon mineral resources than any other. Indeed we can hardly expect to find minerals abundant in a region so generally cultivable and fertile. It is not, however, entirely without interest in this respect. Among other objects worthy of notice I may mention particularly the acid or sour springs in the town of Byron, and which owe their acidity to the presence of pure sulphuric acid in a diluted form. This interesting occurrence was noticed many years ago, and it is almost without a parallel, whether we refer to the strength of the acid or the large quantity which has been formed. My report for 1838 contains a detailed account of some of these springs to which I must refer for further information in regard to them.

Brine springs have also been found in this county, but their waters are not of strength sufficient to admit of their being advantageously used in the manufacture of salt. There are, moreover, some sulphur springs and one or two unimportant localities of sulphate of lime, sulphate of magnesia and sulphate of iron.

GREENE COUNTY.

This county, although very different in its character from the preceding, does not offer much that is interesting to the mineralogist. It contains, however, some useful mineral productions.

Of marl, calcareous tufa and agaric mineral, there are several valuable localities. All these may at some future time be made useful to the agriculturalist. A specimen of marl from the the farm of Mr. Van Bergen near Coxsackie, gave when perfectly dry, the following results in 100 grs.

Carbonate of lime,	97.32
Insoluble matters, principally of silica and alumina,	2.15
Oxide of iron, with vegetable matter,	0.53

Another specimen from the vicinity of Catskill contained

Carbonate of lime,	91.75
Insoluble matters, with some oxide of iron, &c.,	8.25

Of course both of these are sufficiently pure to be advantageously employed as fertilizers.

Some interesting crystalline forms of calcareous spar occur in the fissures of the limestone along the track of the Catskill and Canajoharie rail-road; and there have also been found fine crystals of quartz in cavities in the slate rock, near Catskill. Among these are some modifications which will be particularly described in the final report of this department of the survey.*

The following minerals have also been found in Greene county, viz:

Sulphur—In minute quantities.

Coal—Several unimportant localities.

Sulphate of barytes.

Labradorite—Occasionally found in bowlders.

Alum and sulphate of iron—Both formed by the decomposition of iron pyrites, which is abundant.

Specular iron ore—In small quantities.

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* A dark grey shell limestone found near the paper-mill, two miles N. W. of Catskill, on the Catskill and Canajoharie rail-road, has the following composition:

Silica and alumina,	3.25
Organic matter,	0.25
Carbonate of lime,	95.00

HAMILTON COUNTY.

Until recently this county has been but little known, and I am not prepared at present to give any information concerning its resources. Dr. Emmons reports that it contains several important localities of peat.* It will undoubtedly be found to possess many useful and interesting minerals.

HERKIMER COUNTY.

This county promises at least to be well supplied with iron ore, for in addition to the argillaceous oxide, long known and justly esteemed, a bed of magnetic iron ore has recently been discovered in the town of Salisbury, and which will probably prove to be an important one. I am informed by the Hon. A. Loomis that the vein is from two to eight feet wide, and has been traced about three quarters of a mile. Between one and two hundred tons of ore have been raised, which is highly magnetic, and yields iron of a good quality. I regret that the specimens sent by Mr. Loomis did not reach me in time for a more detailed notice at present.

Within a few years a considerable quantity of gypsum has been obtained in the town of Starke, and it is, I believe, the most eastern point at which this useful mineral has been found in any abundance It is represented by Mr. Vanuxem to be equal to the Nova Scotia, both before and after calcination. Crystals of sulphate of strontian are sometimes associated with the gypsum.

From the specimens of lead ore which have been found in this county, it was supposed by some that workable beds of it would be discovered. Thus far, however, these anticipations have not been realized. Excavations have been made about two miles from Salisbury corners, but they have furnished only cabinet specimens of the sulphurets of lead, zinc, iron and copper, with occasional stains of the green carbonate of copper and bog iron ore ; the former proceeding from the action of the atmosphere upon the pyritous copper, and the latter from the decomposition of the iron pyrites.

The remark just made in regard to lead ore will also apply to the anthracite which has been found here in a state of great purity. After repeated examinations it has been ascertained that the quantity is quite too small to answer any useful purpose.

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* N. Y. Geological Reports, 1839.

Of calcareous tufa, which may be ranked among the useful minerals, Herkimer county has several important localities. One of the most remarkable is that near the head of the Otsquaga creek, where there is a single mass about 300 feet long, 50 wide, and from 10 to 40 thick; and this is constantly increasing in size by the percolation of water charged with carbonate of lime.* There are also a few sulphur springs in this county, from one of which sulphuretted hydrogen is so abundantly evolved, that when fired it will continue to burn on the surface of the water.

This county has been known to mineralogists in consequence of its numerous localities of rock crystal, or false diamond, as it is sometimes called. The best locality at present known is at Middleville, and Mr. Vanuxem in noticing it, has justly observed, that there is probably no place in the world where these crystals are found more numerous, more perfect and more beautiful. They are of various sizes, and often exhibit new and interesting crystalline forms. Some of these have been already described in the recent mineralogical works of Shepard and Dana, but several others have been obtained of which figures will be given in my final report. Not the least curious circumstance connected with these crystals is, that they frequently contain a liquid which is probably bituminous, from the yellowish stain which it leaves in the cavities after it has evaporated. Sometimes the crystals instead of having two perfect terminations, are connected at one end to the rock, presenting surfaces studded with pyramids of the highest finish.

The following may be added to the minerals of this county:

Sulphate of barytes, lamellar and sometimes fetid—Near Little Falls and Fairfield.

Graphite.

Alum and alum slate.

Tourmaline.

Coccolite—In bowlders.

JEFFERSON COUNTY.

Regarding only its mineral resources, this is undoubtedly one of the richest counties in the State. The ores of iron are of course the most important, and they are found in great abundance. Of the specular iron or red oxide, which is the most common, there are here and in the adjoining county vast beds which are extensively wrought. The ore in the town of Antwerp is interesting from its having associated with it crystals of quartz without prisms, and also a mineral new to this county, called cacoxenite. The latter, will be more particularly described in the appendix to this report. I have been informed that there is a valuable bed of magnetic iron ore in the southern part of this county, but I was not so fortunate as to obtain specimens. Bog iron also occurs, but in consequence of the great abundance of the first named kind, it is not used in the manufacture of the metal.

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* Eaton's Canal Rocks, p. 128.

Small quantities of lead and copper ore have been found in various parts of Jefferson county, but their occurrence has not yet led to many extensive mining operations.

On the shore of Lake Ontario, a short distance N. E. of Sackett's Harbor, at a place called Pillar Point, is a locality of sulphate of barytes, where the mineral may be taken out in large blocks. This substance when ground is used as a paint either alone or mixed with white lead, of which last it has become a very common adulterant.

Of the mineral called Rensselaerite by Dr. Emmons, but which has the composition of soapstone, there are several abundant localities in the vicinity of Oxbow. It is sometimes crystalline and sometimes compact, and deserves to be particularly noticed as it is often mistaken for plaster of Paris and has been used as a manure. Chemical analysis however shows that is chiefly composed of silica and magnesia, and it is not probable therefore that it possesses any fertilizing powers.

To the mineralogist, this and the adjoining county (St. Lawrence,) are of great interest in consequence of the crystalline forms which many of its minerals assume. This is especially the case with the calcareous spar of which the varieties are almost innumerable. In the immediate vicinity of Oxbow, huge dodecahedral crystals have been obtained, which by cleavage furnish rhombohedrons, sometimes colourless and sometimes having a delicate rose or purple tint.

Quartz crystals, some of them exhibiting interesting forms and often associated with sulphate of barytes and calcareous spar, occur on the banks of Vrooman and Laidlaw lakes.

An important locality of feldspar is reported to exist on High Island in the St. Lawrence, opposite to Alexandria.* This substance is used in the manufacture of the finer kinds of pottery, and if in abundance will no doubt be valuable.

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* Emmons. N. Y. Geological Reports, 1837, p. 103.

The following minerals also belong to this county :

Graphite—Several localities, but unimportant.

Agaric mineral—In a cave near Watertown.

Sulphate of strontian—Chamont Bay.

Carbonate of Strontian—Associated with fluor spar, according to Dr. Emmons.

Fluor Spar—Banks of Muscolunge lake, crystals of a foot in diameter have been found here.

Phosphate of lime—Banks of Vrooman lake and elsewhere.

Serpentine, massive and crystallized—Near Oxbow, &c.

Amianthus—Associated with the preceding.

Hornblende, tremolite, pargasite—Many localities.

Feldspar—Crystallized.

Mica, crystallized and plumose—Several localities.

Pyroxene—Several localities.

Idocrase, the primary, with the lateral edges truncated—Near Oxbow.

Brucite or chondrodite—Near Oxbow.

Spinelle, of a fine blue colour, and sometimes $\frac{3}{8}$ of an inch in diameter—two localities near Oxbow.

Iron pyrites—The common variety is abundant, the plumose is said to occur in Champion.

KINGS COUNTY.

The only substance heretofore found in this county, which is at all connected with my department of the survey, is peat, reported to be common and sufficiently abundant. Several minerals, however, occur in bowlders, which have been brought hither by some mechanical agencies, the nature of which is not yet understood.

LEWIS COUNTY.

There are few counties in the State more deserving the attention of the mineralogist than this. The cursory examinations which have been made, have resulted in the discovery of many interesting minerals, but when it is recollected that in the western part of the county there is a tract almost unexplored, and which probably contains ranges of primary rocks, there can be little doubt that the number of these will hereafter be greatly increased.

There are in this county some beds of iron ore especially in the town of Watson. The argillaceous variety is believed to be the most abundant. Veins of magnetic iron ore are also found in the primitive rocks on Moose and Black rivers, but neither their extent nor value has yet been determined. I have found magnetic iron sand on the banks of Moose river, near Lyondale. An impure specular ore occurs near the Natural Bridge.*

Black oxide of manganese, or wad, has been found in rounded masses near the summit of Tug hill, but the locality has not been sufficiently explored to determine its extent.

In the vicinity of Martinsburgh and Lowville, veins of galena of various widths traverse the limestone, and mining operations have been carried to some extent. From one of these veins several tons of the ore were obtained, but the quantity was by no means sufficient to meet the outlay which had been incurred. Indeed it is quite doubtful, from what is known concerning the occurrence of this ore, whether it would be prudent to continue these operations.

These veins, however, have furnished some interesting specimens of galena, both crystallized and massive. They are often accompanied by iron pyrites, and at one locality near Martinsburgh, it occurs in flattened wedge form octahedrons. In almost every vein of lead ore, moreover, we find six-sided and lenticular crystals of carbonate of lime, the former of which are also found at Leyden and elsewhere, independently of that association. To these may be added the beautiful cubic crystals of green fluor spar, which occur in one of the veins formerly worked for lead ore, near Lowville.

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*I refer here to a deposite which was strangely enough thought to be silver ore. The specimens which I obtained are of a steel grey colour, sometimes of a greenish tint, resembling chlorite, which mineral they also resemble in structure. The purest of these was found to contain about 50 per cent peroxide of iron, the remaining portion consisting of earthy matters, principally silica mixed with some graphite. It is scarcely necessary for me to add that I could not detect the slightest trace of silver in any of them.

I may here also state that Lewis county contains extensive beds of serpentine. The specimens which we procured from the vicinity of the Natural Bridge, exhibit beautiful shades of colour and take a fine polish. I think it probable that large slabs might be obtained free from checks or flaws.

The following were found in this county by Dr. Horton and myself, during the last summer, viz :

Calcareous spar, of a sky blue colour—Found, as were all the succeeding, in the vicinity of the natural bridge.

Satin spar—In thin veins.

Tabular spar, associated with green coccolite—In the same place and abundant. This is probably one of the localities from whence have been derived those bowlders of the same minerals which occur at Boonville, in Oneida county. (See appendix.)

Phosphate of lime—In small crystals.

Quartz—In large opaque crystals and in druses.

Feldspar—Crystallized and massive.

Scapolite—In crystals of a grey colour and exhibiting the appearance of having been fused.

Pyroxene—Crystallized and black.

Sphene—Associated with the pyroxene and scapolite. The crystals are sometimes large and fine, but perfect specimens are with difficulty obtained.

Mica—In small crystals, abundant.

Iron pyrites—Abundant.

LIVINGSTON COUNTY.

The most important mineral in this county is gypsum, which has been found in various places and is probably in sufficient abundance for all the uses to which it is commonly applied.

Salt water has been found near York, a fact which is chiefly interesting in a geographical notice of our brine springs, as neither the strength of the water nor its quantity give it any importance in an economical point of view.

The sulphur springs of Avon have long been celebrated and their value has been tested by thousands of persons. They are undoubtedly to be ranked among the most important springs of this class in the United States.

Bog iron ore is said to occur in considerable abundance in this county, and if we add to this an unimportant locality of coal, we have noticed all the mineral substances which are at present known to exist in it.

MADISON COUNTY.

Two very important mineral productions were at an early period discovered in this county, viz. gypsum and water limestone. Both of them have been found in abundance and have been a source of wealth to its citizens. The contiguity of these localities to the Erie canal, affords facilities not often possessed for transporting the surplus to distant parts of the State. A particular account of the gypsum beds and water limestone quarries of this county will be found in my last annual report.

Another mineral which is here abundant, and which in some parts of the State would be thought invaluable, is marl. There is a deposit of it near Chittenango, and Mr. Vanuxem informs us that the Cowasalon swamp, which contains about ten thousand acres, is a vast accumulation of marl, of unascertained depth.* Besides this, most of the ponds in this county have bottoms of the same substance.

Some years since borings were made for salt water in Lenox, but although brine was found, the enterprize proved disastrous to those who were engaged in it.

Bog iron ore has been found in various parts of this county, but not in abundance.

There are two important sulphur springs near Chittenango. They are highly charged with gas, are pleasantly situated, and rank next to the Avon springs in the quantity of water which they yield.

To the scientific, as well as merely curious traveller, the vicinity of Chittenango has for many years possessed considerable interest in consequence of the singular and abundant specimens of calcareous tufa which are there found. The petrified tree, so long known, has indeed disappeared, but the whole base of the hill opposite to the village still exhibits specimens of a similar kind. These too appear to be continually increasing in number by the percolation of water through the calciferous slate of which the hill is composed.

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* New-York Geological Reports, 1839, p. 280.

There are a few other minerals in this county, viz:

Sulphur—Sometimes found associated with gypsum.

Sulphate of barytes—In the bituminous limestone near Chittenango.

Hydrate of iron, staining calcareous tufa; called by Mr. Vanuxem, tufaceous iron ore.

MONROE COUNTY.

The mineralogical characters of this county are not unlike to those of the preceding. Of the argillaceous iron ore, so widely diffused through the western part of the State, we have here several localities. In addition to this magnetic iron, sand has been found in considerable abundance on the shores of Lake Ontario.

In the vicinity of Rochester small quantities of the sulphurets of lead and zinc have been found in the limestone. A company was once formed for working one of the veins, but it is needless to say that they soon became satisfied that the pursuit was visionary.

Of gypsum and marl there are here several important deposits, especially in the southern part of the county; while calcareous tufa. is also abundant. All these may be advantageously employed as fertilizers and for other purposes.

No county in the State is more largely supplied with sulphur springs than this. Indeed, it would seem that the evolution of sulphuretted hydrogen is in some way or other connected with the rock strata which characterize it. In some instances, these springs are highly charged with the gas, and have become places of much resort. Bathing houses, and houses for the accommodation of visitors, have been erected at many of them. The Caledonia spring, in the town of Wheatland, is remarkable for the large quantity of sulphuretted water which it contains.

In Riga there are springs which give out carburetted hydrogen gas in such quantities as to supply a constant flame. And it may also be added, that several brine springs have been discovered in this county, but none of them are of any importance.

To the above are to be added the following minerals, which have been found in Monroe county, viz:

Fluor spar—In the limestone near Rochester; in cubes, which are sometimes of a bluish tint.

Pearl spar, having the crystals bent and twisted—Rochester.

Calcareous spar, usually in dodecahedrons—With the preceding.

Sulphate of magnesia, sulphate of iron, muriate of soda and alum—Found in the form of efflorescences on rocks.

Snowy gypsum in nodules—Rochester.

Sulphate of barytes, of a flesh red color. In nodules in limestone—Rochester.

Sulphate of strontian—Sometimes found with the preceding.

Garnet sand—Associated with iron sand on the shores of Lake Ontario.

Iron pyrites—Abundant.

MONTGOMERY COUNTY.

Few minerals have hitherto been found in this county. The most important, perhaps, is marl, which is said to occur in several places, and in considerable abundance.

Mining operations, however, have been prosecuted to some extent, with a view to the opening of veins of lead ore which have been discovered on Flat creek, near Spraker's Basin. Good specimens of this ore have been obtained at this locality, but the question whether it exists in any quantity, is still undecided.

The following minerals have also been found to occur in this county, viz:

Calcareous tufa, calcareous spar, stalactite, &c.—Mitchell's cave.

Sulphate of barytes, the lamellar variety.

Brown spar.

Anthracite—In small seams, and also inclosed in quartz crystals.

Quartz, crystallized, sometimes having one end globular and smooth, as if fused; also calcedony and agate.

Garnet, of pink colour—In the gneiss at the Noses.

Sulphuret of zinc—Associated with galena.

Oxide of titanium—In minute crystals in calcareous spar, near Sprakers. *Mather.*

NEW-YORK COUNTY.

Although the number of minerals in this county is comparatively large, few of them belong to the class usually denominated useful. Carbonate of lime, in various forms, has indeed been found in abundance. Bog iron ore, and the oxide of manganese also occur, but in quantities entirely too small to answer any valuable purpose.

The following is as complete a list of the minerals of New-York island as I have been able to prepare:

Carbonic acid gas—Given out by a spring in the city.

Graphite—Several unimportant localities.

Carbonate of soda—Often formed on damp walls in various parts of the city.

Calcareous spar—Several localities.

Brown spar—Ditto.

Dolomite, or magnesian carbonate of lime, generally called marble—Several localities.

Phosphate of lime, crystallized—In dolomite.

Datholite—In bowlders, which are similar to the rock found at Bergen-Hill, New-Jersey.

Quartz, crystallized, limpid and of a rose colour; also hornstone, jasper, basanite, and fetid quartz—In various parts of the island.

Serpentine, common and precious—In bowlders in the southern part of the island.

White pyroxene, sometimes in four-sided tables--At the old quarries at Kingsbridge, about 208th street.

Actynolite—In bowlders in the southern part of the island, supposed to be from the locality of hydrous anthophyllite.

Tremolite—At the old marble quarries near 208th street.

Hydrous anthophyllite—In bowlders on various parts of the island, and in places between 10th avenue and the Hudson, and between 57th and 63d streets.—(*Dr. Gale.*)*

Manganesian garnet—At Corlaer's Hook, (*Pierce and Torrey in Cleveland*); also on the shore of the Hudson, between 42d and 50th streets.—(*Dr. Gale.*)

Kyanite—Found in loose fragments.

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* **Report to Mr. Mather—New-York Geological Reports, 1839.**

Adularia, crystallized; and fetid feldspar—The former found in veins of quartz; the latter in limestone.

Stilbite, red—On gneiss near the rail-road tunnel.

Mesotype—In cavities and veins in greenstone bowlders. Perhaps the stellite of Dr. Thomson. (See appendix.)

Epidote—Small crystals in veins of gneiss.

Amianthus—Associated with serpentine.

Chlorite—On the Hudson and in bowlders.

Mica, laminated and in six sided tables.

Tourmaline, the common and the blue, or indicolite.—On the Harlæm rail-road.

Apophyllite—In greenstone bowlders.

Iron pyrites, in cubes and dodecahedrons—Limestone quarries.

Rutile, or oxide of titanium—In the limestone quarries near Kingsbridge.

Sphene—With the preceding.

Beryl—In small, pale green, semi-transparent crystals, in granite.—(*Pierce & Torrey, in Cleveland.*)

Staurotide—On the banks of the Hudson, in mica slate.

Sulphuret of molybdenum—In gneiss.—(*Pierce & Torrey.*)

NIAGARA COUNTY.

The mineral localities of this county, although at present not numerous, are such as to attract the attention of the traveller. The most important of these are in the immediate vicinity of the Falls of Niagara, and at the deep rock excavation near Lockport. The geodes which are here found in the limestone contain specimens of uncommon beauty, consisting of sulphate of strontian, calcareous spar, anhydrous sulphate of lime, selenite, pearl spar and occasionally fluor spar, and sulphuret of zinc. These minerals undoubtedly exist in many other parts of this county, but in consequence of the extensive operations at Lockport, they are there more abundantly obtained than elsewhere.

Of bog iron ore, there are several localities in Niagara county, but none of them are of especial importance. The deposits of calcareous tufa are very abundant, particularly near the Falls, from which it is evident that the waters of Lake Erie hold in solution a portion of carbonate of lime.

Sulphur springs occur near the Falls of Niagara, at Lockport, and elsewhere in this county. Some of them are well charged with gas, and hold in solution small quantities of sulphate of magnesia. To these may also be added, a chalybeate spring, some unimportant brine springs, and a gas spring, so called; from the latter of which, carburetted hydrogen gas is evolved in considerable abundance.

I should not omit to state, that beautiful geodes of crystallized quartz, sometimes passing into calcedony and agate, are found near Niagara Falls; and Mr. Vanuxem has observed minute quantities of copper pyrites and green carbonate of copper at Lockport.

ONEIDA COUNTY.

The mineralogy of this county is in many respects similar to that of the counties which lie west of it. Several important and useful products occur in it in great abundance. Among these may be enumerated the argillaceous clay iron ore in beds from twelve to twenty inches in thickness. The character of this ore is so well established that several furnaces are supplied with it from this county. Gypsum also is found here in beds of vast extent, especially on Oneida creek. To these may be added water limestone of which according to Mr. Vanuxem there are immense series; and peat and marl are said, also, to occur in this county.

Oneida county is plentifully supplied with mineral springs of various kinds. Sulphur springs are quite numerous; weak brine springs are occasionally found, and near Vernon village, carburetted hydrogen gas issues through a spring at the rate of about a gallon a minute.* It burns with a flame of a reddish white colour.

The following are also to be included among the minerals of this county:

Anthracite—In small quantities.

Sulphate of barytes, sometimes called Barystrontianite—Near Hamilton College.

Calcareous spar, sometimes presenting interesting forms—Several localities.

Sulphate of magnesia—In solution, in springs.

Quartz, crystallized, and massive.

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* Eaton, in Silliman's Journal, XV. 236.

Tabular spar—In bowlders near Boonville, associated with green coccolite, green pyroxene and brown granular garnet—The specimens are often of great beauty.*

Sulphuret of lead, associated with sulphuret of zinc, the latter also alone—One or two unimportant localities.

Sulphuret of copper—With the preceding but still more rare.

Sulphate of iron and alum—Formed by the decomposition of iron pyrites, which, as usual, is abundant.

ONONDAGA COUNTY.

We have in this county a fine illustration of the influence which important mineral productions exert upon the prosperity of a people. When brine springs were first discovered in this part of the State, it could hardly have been anticipated that they would in so short a time, have yielded such a large return. As I have in a former report given a detailed account of the brine springs of this county, and have offered such suggestions as occurred to me in regard to the manufacture of salt, it will not be necessary to occupy much time with them at present. I may be permitted, however, again to advert to the importance of an attention to this manufacture as one in which the State is deeply interested, and for the improvement of which no trifling expenditure should be regarded. The erection of a State reservoir for the purification of the brine cannot be too strongly insisted on. By such an apparatus much waste would be prevented, the salt rendered more pure and the expense of manufacturing it greatly reduced.

Besides the invaluable brine springs which this county contains, it is well supplied with many other useful mineral productions. Among these we may reckon several important beds and quarries of the argillaceous oxide of iron, of gypsum, marl and water limestone, which are found in abundance for all the uses to which they are ordinarily applied. Of gypsum there is probably on the Auburn and Syracuse rail-road, one of the most extensive beds to be found in the State, and as for marl, the bed of the Onondaga lake is entirely composed of it ; while all around it, in the vicinity of Syracuse and in other parts of the county, there are deposits of similar kind.

Among the objects which in this county engage the attention of the mineralogist are the extensive calcareous depositions which are found especially along the line of the Auburn and Syracuse rail-road. These present a considerable variety, being sometimes crystallized, sometimes fibrous, snow-white or of a yellowish colour.* The fibrous specimens, often of great beauty, have been called arragonite, but I think it may be safely said that they do not belong to that species. The tufa is sometimes stained with hydrate of iron, forming what Mr. Vanuxem has called tufaceous iron ore.

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* **Prof. O. P. Hubbard, in Silliman's Journal, XXXII, 230.**

Associated with the gypsum in the extensive beds to which I have already referred, there are often large and beautiful folia of transparent selenite, together with veins of the fibrous variety of that mineral. Small masses of sulphur, probably arising from the decomposition of the gypsum, are also occasionally observed.

There are in Onondaga county several sulphur springs, one of which has acquired some celebrity. It is a curious fact that sulphuretted hydrogen gas is very abundantly given off from weak brine springs in the immediate vicinity of the State wells at Salina and Syracuse. Whether it arises from the same source as the salt water is a problem which I am not prepared to solve.

I have only to add that fluor spar, of a deep purple colour, is occasionally met with in the calcareous spar, which is associated with the water limestone series at Manlius, and that a peculiar variety of serpentine has been noticed by Mr. Vanuxem in the vicinity of Syracuse.†

ONTARIO COUNTY.

With the exception of the numerous brine springs, the mineral productions of this county, are quite similar to those of the preceding. Of iron ore, gypsum and marl, there are here most abundant deposits, fully equal indeed to any demands which may be made upon them.

One of the most interesting features in the mineralogical history of this county, is the abundant evolution of inflammable gas, or carburetted hydrogen. These springs, however, have been so fully described in my second annual report, that I need not notice them more particularly at present.

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* From a snow-white and fibrous specimen, I obtained 99.25 per cent of pure carbonate of lime.

† New-York Geological Reports, 1839 p. 283.

We notice here the occurrence of sulphuric acid in small quantities in a spring, and a deposit of sulphur, from the same source. Petroleum floats upon the surface of some lakes, but it is not abundant. Magnetic iron sand is found near Geneva, while fluor spar, calcedony, and sulphate of strontian also occur, and are to be ranked among the minerals of this county. Finally, iron pyrites and the salts to which by its decompositon, it usually gives rise, are here, as in many other parts of the State, widely diffused.

ORANGE COUNTY.

The mineral productions of this county, are fully as interesting and important, if not more so, than those of any other in the State. Its catalogue of minerals indeed, is by far the most extensive, a fact which may be owing in part, to the thorough manner in which it has been explored. There have for many years resided in this county, several gentlemen who were zealous in the pursuit of mineralogy, and the fine cabinets which are now to be found in it, attest the success which has attended their researches.

The report of Dr. Horton, published in the last annual communication from the Board of Geologists, contains so complete a catalogue of the minerals of Orange county, that it is unnecessary for me to occupy space with a similar enumeration. It may be remarked, however, that the important mineral product of this county, is magnetic iron ore, of which there are vast beds situated chiefly in the town of Monroe. In no part of the State, and perhaps of the world, is there, in an equal area, so large a quantity of this important mineral. Nor is there any district which promises to be so much advantaged by the great project of internal improvement now in progress, as the one in question.

A bed of magnetic iron ore, has been recently opened near the village of Canterbury. The ore is of good quality, and the local situation of the mine, gives it a decided advantage over many others of similar kind.

Besides this, the hematitic ore is also found in abundance, and it will no doubt be of great value whether used separately, or in mixture with the magnetic ores.

During the last season, Dr. Horton and myself discovered in the vicinity of the bed of magnetic iron, above referred to, a new locality of the Ilmenite, a rare mineral, of which there were previously known two localities in other parts of this county. Another very rare mineral has been recently found here; viz. Allanite. (See Appendix.)

A notice of several interesting minerals obtained in this county, must now be reserved for the final report, as I have not yet had time to complete their chemical examination.*

ORLEANS COUNTY.

The mineralogy of this county, so far at least as it is at present known, is exceedingly simple. Several brine springs have been found in various parts of it, and some of them were formerly used to a limited extent in the manufacture of salt. But they are now entirely neglected. There are also one or two sulphur springs, and some deposits of bog iron ore ; but there is only one locality of the latter, where the mineral is in sufficient quantity, to be of any use in the manufacture of iron.

OSWEGO COUNTY.

Still more barren of minerals, than the last ; for we have only to notice some unimportant brine springs, and a locality of bog iron ore, which is of trifling importance.

OTSEGO COUNTY.

This county contains abundance of good marble, and several sulphur springs, one or two of which are in considerable repute. Calcareous tufa is found near them, and also selenite and gypsum in small quantities. These together with a weak brine spring are, I believe, the only mineral productions, thus far credited to this county. I should add, however, that a mass of native iron, probably of meteoric origin, was some years since found near Burlington.

PUTNAM COUNTY.

As might be inferred from the geological characters of this county, its mineral productions are of much interest. Pursuing the order which has been heretofore adopted, it may be observed, that in iron ore, this county is peculiarly rich. It contains several beds, or veins of the magnetic kind, which yields ore of the best quality, and in the greatest abundance. These deposites have been minutely described, by Mr. Mather, in his report of last year.

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* Of several specimens of marl which I have received from this county, I have only had time to analyze one, and that is from the lands of Gen. Wickham. Its composition in 100 grains is as follows:

Insoluble matters, (silica and alumina)............	6.25
Carbonate of lime,..................................	93.75

Of carbonate of lime, in the form of calcareous spar, and marble, there are several localities. The latter term, however, is usually applied here to a dolomite similar to that of Dutchess county, and which is found abundantly in the vicinity of Patterson. The only objection to this material for construction, is its friable character.* Being a compound of the carbonates of lime, and magnesia, it has been thought that the product of its calcination, is not so valuable, as a fertilizing agent, as that which contains lime alone. On this subject, however, as I have already remarked, mistaken views have been entertained, as some soils which appear to have been formed in part of the magnesian limestone are by no means wanting in fertility. It may be added that a white crystalline limestone occurs in this county which is entirely free from magnesia.

A very valuable mineral product of Putnam county is serpentine, which exists in vast quantity, can be obtained in blocks of uniform density, and is susceptible of a fine polish. But for the fact that the quarries of this beautiful material are situated at too great a distance from water transport, they would long ago have been extensively wrought. Of the precious or noble serpentine, also, there are several localities where the mineralogist may obtain specimens equal in beauty to any that are found in the United States.

Among the objects worthy of notice in this connexion are two localities of arsenical iron pyrites, one of which has at some former period been extensively wrought. This ore which might be used for the extraction of arsenic, seems to be abundant, but the present condition of the mine renders it difficult to arrive at a certain conclusion on this subject. Its reported mixture with silver is probably one of those stories circulated for selfish purposes, and the only ground for it in the present instance is, the fact that in other countries, the arsenical ores are often associated with those of a more valuable metal.

I should not omit to add that a bed of limonite or hydrate of iron, occurs in Peekskill Hollow, near the line between Philipstown and Carmel. Mr. Mather, however, remarks that it seems to be too siliceous to work well alone in the furnace. There are also several localities of peat, and probably marl will hereafter be found accompanying this substance as it does in several other counties.

Putnam county has for many years been visited by mineralogists chiefly on account of the interesting localities which occur at Cold Spring and in Philipstown. The latter, on the farm of Mr. Hustis about five miles south of the village of Fishkill, is particularly worthy of attention, not only for the number of interesting minerals which it affords, but as showing the manner in which allied species run into each other. The facts here presented prove how important it is in many cases carefully to examine the localities of minerals before we decide with certainty upon their specific characters.

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* The Putnam county dolomite often contains a large admixture of tremolite.

In a bed of white limestone running parallel with the granite and which is of small width and is situated about a quarter of a mile from the New-York road, we have the following minerals, viz: Precious serpentine, of which there are several varieties. The first, has a conchoidal fracture and presents various shades of green and yellow and is variously disseminated through the limestone and other minerals. 2. A slaty variety, having a dark green colour. It sometimes breaks into rhomboidal prisms and is very hard and compact. 3. A slaty variety of a greenish white colour, is harder than the preceding, and is fusible upon the thin edges by the blow-pipe. This last seems to approach jade or saussurite in its characters, but its peculiarities are probably owing to the admixture of some other minerals, as all these varieties seem to pass into each other by almost imperceptible gradation.

Of the magnesian carbonate of lime several forms occur at the locality in question. There is a thin stratum which is snow-white, very close grained, compact and has a semiopaline appearance. It is sometimes described under the name of Gurhofite, from its having been first found near Gurhof, in Austria. According to my analysis its composition is as follows, viz:

Silica,	6.50
Carbonate of lime,	66.75
Carbonate of magnesia,	26.50

Other specimens of this mineral have fibres of asbestus running through them and they sometimes have a bluish tint, a slaty structure, and contain crystals of bronze yellow iron pyrites.

Asbestus, especially in the amianthoid form, is indeed largely mixed with the minerals already noticed. The beautiful silky fibres which run through the serpentine and magnesian limestone in various parts of this ridge may belong to the picrolite of the more recent authors. But while I have no doubt that several distinct minerals have heretofore been confounded under the name of asbestus. I have not satisfied myself of the identity of our mineral with that just mentioned. Some of the specimens found here have a fibrous structure, and a silky lustre, but on treating them with acids they effervesce, and after dissolving out all the magnesian carbonate of lime, bundles of amianthoid fibres remain. I have reason to believe that all the different fibrous minerals found here are mixtures of asbestus with serpentine or magnesian carbonate of lime.

The following is an enumeration of the remaining minerals found in this county:

Pyroxene—The variety coccolite, of a white colour. It is made up of grains of various sizes and resembles dolomite—Philipstown.

Diopside or white augite, associated with the preceding. It has a grey colour, and foliated structure.

Tremolite—Often associated with yellowish serpentine.

Chrome iron ore—In octahedral crystals—One specimen has a crystal with the base $\frac{1}{4}$ of an inch in diameter. It resembles spinelle, but its powder is attracted by the magnet, and its blow-pipe characters agree with those of the chrome ore—Philipstown.

Scapolite, in small crystals or grains.

Phosphate of lime, in very minute crystals. Both these are found at the above locality.

Peat—Several localities, according to Mr. Mather.

Graphite—Often found in small quantities.

Arragonite?—In concretions on dolomite, near Patterson.

Hyalite—Associated with iron ore at the Philip's ore bed.

Basanite—Loose masses on the banks of the Hudson.

Kerolite—Philipstown.

Brucite—Near the Townsend ore bed.

Hornblende—Several varieties. Actynolite, found at Brown's quarry. Tremolite—very abundant in the dolomite near Patterson.

Asbestus and amianthus, in long and tough fibres—Abundant near Patterson.

Schiller spar, of Dr. Thomson—Brown's quarry, (see appendix.)

Feldspar—Several varieties.

Albite, in large crystals—Near Patterson.

Laumonite, stilbite and chabasie—Formerly obtained at Coldspring. The locality is believed to be exhausted.

Epidote, in beautiful crystals—Near Carmel.

Mica—Several localities.

Zircon—Formerly obtained at Cold Spring.

Iron pyrites—Associated with magnetic iron ore. By long exposure to the weather the iron pyrites is decomposed, and the resulting salt washed out.

Pyritous copper and green carbonate of copper—Philip's ore bed.

Sphene—At the Philips ore bed, and formerly at Cold Spring.

Orpiment or yellow sulphuret of arsenic—Formed on the timbers of the old arsenic mine by the decomposition of the arsenical iron pyrites.

Copperas or sulphate of iron—Formed by the decomposition of iron pyrites, on the farm of J. Wood, six miles S. S. E. of Carmel.

QUEENS COUNTY.

The only substance at all connected with this department of the survey, in this county, is peat, of which Mr. Mather informs us that there are several localities.* Many of the minerals, however, found in other parts of the State occur here in bowlders.

RENSSELAER COUNTY.

This county does not contain many useful minerals, strictly so called, and there are but few that possess much interest to the mineralogist. As a geological survey of it was made by Professor Eaton, in 1821, its productions are probably as well known as those of any other county.

In an economical point of view, one of the most important substances here found is marl, of which there is a bed in the town of Schaghticoke. The same substance, but more pure, occurs in various parts of the town of Sand Lake.

Sulphur springs abound in this county, and some of them have acquired celebrity for their supposed medicinal properties. But these as they are found in almost every county in the State, do not excite so much interest as the springs of Hoosick, which, like the Lebanon springs, are remarkable for the evolution of nitrogen gas, which is constantly going on.

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* New-York Geological Reports, 1338, p. 122.

There are in Rensselaer county several localities of crystallized quartz, occurring in fissures in the rock. One of these is at Lansingburgh, and was formerly known by the name of Diamond Rock. But it has long since been shorn of its beauty. This mineral, (quartz,) in the form of basanite and jasper, are also occasionally met with. Inferior specimens of calcareous spar, and thin seams of anthracite are to be noticed as among the minerals of this county. Iron pyrites is abundantly diffused and as usual gives rise by its decomposition, to the formation of the sulphates of iron and magnesia. To the preceding list are only to be added slaty chorite and oxide of manganese, which are occasionally found, together with loose masses of hematitic iron.

RICHMOND COUNTY.

This county is exceedingly interesting to the mineralogist, not so much on account of the variety of minerals that are found in it, but of the manner in which they are associated and pass into one another. Indeed, the remarks which were made under Putnam county are generally applicable here. A fine illustration of this grouping of minerals may be observed very near the quarantine. At this locality, which is on the road side, a short distance from the old pavilion, will be found a serpentine rock, embracing veins of asbestus, assuming every variety from the compact and ligniform to the amianthoid, depending in a great measure upon the exposure to which it has been subjected. We obtained specimens of the fibrous kind a foot or more in length. A little further on we find masses of precious serpentine, with veins of the marmolite of Mr. Nuttall, but which, although differing somewhat from serpentine in its external characters, is closely allied to, if not identical with, it. Then we have the magnesian marble of Nuttall, or the white compact carbonate of lime and magnesia, with a conchoidal fracture, and a hardness that sometimes causes it to strike fire with steel. This upon analysis proves to be identical with the gurhofite, noticed among the minerals of Putnam county. And with these again are associated some varieties of talc, and more rarely the hydrate and carbonate of magnesia, and the chromate of iron. There are many intermediate or transition states, of these minerals, which in hand specimens might pass for distinct ones, but an attentive examination of the locality, will show their true characters and save the chemist much labor and anxiety.

These occurrences, moreover, are repeated in other parts of this county.

Near the central part of Staten-Island there are several important beds of hematitic iron ore, which are used at some distant furnaces, and are said to yield iron of a good quality. And the hill which forms the spine of the county contains many localities of ferruginous quartz, which in some cases passes into calcedony.

Near Rossville, there is a stratum of lignite associated with iron pyrites of a brilliant metallic lustre when first obtained, but which is lost upon exposure to the air.

Thin plates of feldspar and crystals of quartz occur at the so called granite quarry, near Merserole's ferry. As this rock is entirely similar to that of Bergen Hill, in New-Jersey, it is not improbable that should the quarrying be continued, the greenstone minerals will be found here in place as they have already been in bowlders.

I will add only that peat is said to be abundant in this county, and that it contains a chalybeate spring which is, however, of little importance.

ROCKLAND COUNTY.

This county forms a part of the boundary between New-York and New-Jersey, and was particularly examined during the last season, for the purpose of ascertaining whether it contained the interesting minerals found in the trappean ranges of the latter State. The result has confirmed the opinion which I have entertained, that this was the case, and the catalogue of our minerals will now include many species which have hitherto been found only in loose masses, of doubtful origin. The best locality for studying these minerals in the county of Rockland, and of comparing them with those of Bergen Hill and Paterson, is at Tappan Slote, where excavations for the termination of the Erie rail-road have for some time been actively prosecuted. Although the specimens seldom possess the beauty of those from the New-Jersey localities, they are sufficiently well characterized.

The minerals noticed here, and in other parts of the Palissado range, are as follows:

Stellite—A new mineral described by Dr. Thomson, and which will be more particularly noticed in the appendix to this report. Also, prehnite, datholite and stilbite.

Nemalite, resembling asbestus.

Calcareous spar, nearly in the form of cubes, the *cuboide* of Hauy; and the same assuming the form of datholite, for which it may be mistaken. The action of dilute muriatic acid, however, will serve to distinguish them.

Galena—In minute crystals or grains.

Apophyllite. This occurs in a variety of forms at Bergen Hill.

Stillbite. Sometimes colourless, and sometimes of a straw colour. Chabazie occurs at Bergen Hill, but I have not yet found well characterized specimens in Rockland.

There is another interesting locality at Stony-Point, near the lighthouse. On the western side of this Point, there is a coarsely crystallized hornblende, and with this is associated the mineral usually called kerolite, or magnesite. Two parallel dykes of trap pass up the northwestern face of the Point, and are distinctly visible by a coating of white magnesian minerals. The rock which has formed the wall of these dykes has disintegrated, and the debris cover the whole of the side hill. The trap is filled with veins of kerolite of different varieties, some of which closely resemble those of Hoboken and Staten-Island. There are also other magnesian minerals, and veins of a beautiful silky amianthus are not uncommon.

About two and a half miles west of Grassy-Point, there is a beautiful variegated marble, which is susceptible of a fine polish, but it does not appear to be abundant. Associated with this, are sometimes found epidote, crystallized hornblende, and feldspar. A quarry of dove-coloured marble occurs on the banks of the Minischecongo creek. The following is its composition in 100 parts, viz.

Insoluble matter, consisting of silica and alumina, ...	3.75
Carbonate of lime, ...	93.50
Moisture and loss, ...	2.75

So that it is sufficiently pure to be burned into lime.*

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* A blue limestone, found near Stony-Point, and which is used for obtaining lime at New-Brunswick, New-Jersey, contains

Silica and alumina, ...	7.25
Carbonate of lime, ...	92.75

Near Ramapo, there often are found in the granitic rocks, masses of magnetic oxide of iron, but this ore has not hitherto been found here in such quantities as to render it of any importance in an economical point of view. Thin strata of the hematitic ore also occasionally occur, and there are some small deposits of the earthy black oxide of manganese. To these I may add peat, of which there are said to be several localities.

The mineralogy of Rockland also includes the following, viz.

Iron pyrites.

Carbonate of copper and red oxide of copper—Staining the trap rocks near Ladenton.

Zircon—In granitic bowlders, near Ladenton.

Hornblende—Several varieties in the trap at Haverstraw, and elsewhere.

Agate—In small nodules in trap.

Quartz and feldspar—Several localities.

ST. LAWRENCE COUNTY.

Next to Orange, this county has the most extensive catalogue of minerals of any in the State; but in regard to the value of these products it may perhaps be placed at the head of the list. Embracing, as it does, such a large extent of territory, a part of which is still almost a wilderness, it is not surprising that it has been but partially explored. Indeed it will probably be a long time before its great mineral resources will be fully understood, or duly appreciated.

The most important mineral at present known in this county is lead ore, which occurs in various places, but which is obtained in large quantities only in the vicinity of the village of Rossie. All the more important veins of this ore have been so fully described in the previous reports of the survey, that little need be said concerning them on the present occasion. I believe no new discoveries of any importance have been made during the last year, and the mining operations have not materially changed their character. There have been, it is true, as is generally the case in the business of mining, fluctuations in the prospects of those who are interested in these mines; the veins sometimes becoming narrower and less rich, and at others again, wider and more productive. But upon the whole, the condition of the mines is about the same as heretofore, with the exception that as the excavations proceed the expense of raising the ore is increased.

These mines are of great interest to the mineralogist in consequence of the perfection and beauty of the crystals of galena and of the accompanying minerals. The galena occurs in the form of the cube variously modified, while of calcareous spar the varieties of form are almost innumerable. It will require a long and patient examination to describe the new and interesting varieties which have here been found. The same remark also applies to the iron pyrites, crystals of which are found associated with the galena in the form of the cube, dodecahedron and others. Fluor spar also occurs in the form of the octahedron and cubo-octahedron. Add to these the splendid specimens of crystallized sulphate of strontian which have recently been found in the Rossie vein, and we have a locality which will compare with almost any in the world.

It is much to be regretted that the proprietors of these mines should have neglected to reserve a complete suite of the minerals found in them, as it would not only be of use in the mining operations, but would give those who might be desirous of studying these minerals an opportunity of so doing. Perhaps it is not yet too late to supply the deficiency. I trust I shall be excused for suggesting the propriety of making a similar collection for the State Cabinet. The value and importance of these mines would thus be more fully brought before the public, science would reap benefit, while the interests of the proprietors would be no less promoted. The adoption of some such plan as that now proposed is particularly important to those who are engaged in the study of our minerals, for the most interesting specimens are usually valued at such a high price as to place them entirely beyond the reach of ordinary mineralogists. I do not object to the sale of specimens from important localities, but to the manner in which it is here conducted. It would be far better for all parties if the superintendents of the mines should take the matter into their own hands. By paying the miners a reasonable price for good specimens, they would feel an interest in obtaining them, and the whole might then be exposed for sale at the office of the establishment.

Of the ores of zinc and copper, which have been found in various parts of this county, I have little to say. From the frequency of their occurrence, it seems not improbable that they exist in abundance, but on this point we are at present left entirely to conjecture.

The deposits of iron ore are truly enormous. The magnetic kind, though less common, is found in several places and is of a good quality.

But of the specular ore, sometimes assuming the compact form, localities abound in the towns of Rossie, Gouverneur, Edwards, Fowler, Hermon and De Kalb. Indeed, it forms one of the great staples of the county.

The iron ore last mentioned is almost always associated with quartz crystals in which the prisms are either very short or are entirely wanting. Sometimes these crystals are of considerable size and of great beauty. At the Parish ore bed there are also found arragonite, calcareous spar in dodecahedral crystals, sulphate of barytes, carbonate of iron or ankerite and the jaspery iron ore.

Finally bog iron ore is also found in various parts of St. Lawrence, and its quality has been abundantly tested by long use in the furnace.

Leaving now the metallic minerals we notice the abundant deposits of carbonate of lime in the form of marble of the common white and clouded, the dolomitic and the serpentine varieties. These are all found in various parts of the county and must hereafter be sources of wealth. Tufa and marl are also occasionally met with; the latter, will undoubtedly be of great use as a fertilizer. An extensive and valuable deposit of hydraulic limestone exists on the St. Lawrence.

It may also be added that the peculiar form of soapstone which I have noticed under the head of Jefferson county, abounds here and often passes by the name of plaster. It is not a little surprising that in the town of Rossie this article had actually been prepared in large quantities and sold at a high price, and that certificates have been published setting forth its value as a manure. It is barely possible that such a compound may prove beneficial on some of the sandy soils of St. Lawrence, but it is much more probable that it will generally be injurious. Be this however as it may, it is neither similar to plaster of Paris nor in any respect like it in its action upon soils. I make this statement entirely from a sense of duty and as a caution to those who might be misled by the inaccurate or interested statements which have been made in regard to the article in question.

The following list will, I think, include nearly all the remaining minerals of this county:

Sulphuretted hydrogen gas—Given out by a spring at Massena which is much resorted to.

Graphite—Several localities—It will probably be found abundant.

Sulphate of barytes—Several localities. Sometimes it exhibits interesting crystalline forms.

Satin spar, agaric mineral and calcareous tufa. All these forms of carbonate of lime are found in this county.

Magnesian carbonate of lime—Gouverneur.

Phosphate of lime, crystallized—Governeur, Robinson's mine, and elsewhere in the town of Rossie. The specimens from Robinson's mine are often very large and perfect. One crystal has been obtained weighing eighteen pounds!

Quartz, crystallized, limpid and smoky; also other varieties.

Brucite—Near Sumerville.

Talc—Several varieties—De Kalb and elsewhere.

Pyroxene, in all its varieties. Abundant.

Hornblende—Several varieties, as Pargasite, tremolite, &c. Rossie and Gouverneur.

Asbestus—Gouverneur and De Kalb.

Terenite, of Emmons—Probably in Jefferson county.

Feldspar, common and crystallized—Rossie and Gouverneur.

Albite—According to Dr. Emmons this mineral is found in the granite rocks of this county.

Labradorite—In bowlders near Ogdensburgh, and elsewhere.

Mica—Several interesting localities in Rossie, Fowler, Edwards and Morristown.

Spinelle—Rossie.

Tourmaline, brown and black—Several localities.

Zircon, in beautiful crystals—At Robinson's mine, Rossie.

Babingtonite—According to Dr. Shepard this mineral is found at Gouverneur.

Titaniferous iron. Probably several of the iron ores contain titanium, as this metal has been found in the slag of furnaces.

Sphene—Several localities.

SARATOGA COUNTY.

This county has been long celebrated for the remarkable mineral springs which it contains. These, as is well known, are chiefly situated in or very near to the villages of Saratoga and Ballston. To the account which I have already given of these waters, I have nothing to add at present, except that one or two new springs have been recently discovered at Saratoga which are thought to rival those that have heretofore maintained the ascendancy. In matters of this kind, however, the public are better qualified to come to a correct decision than those individuals whose interests are immediately concerned.

Among the useful mineral productions of this county may be mentioned marl and bog iron ore, of which there are several localities. The magnetic oxide and hematite are also found, but heretofore only in very small quantities.

In the immediate vicinity of Saratoga Springs, there are several interesting minerals. Thus agate and calcedony are found associated with a siliceous limestone. The rare chrysoberyl, presenting some interesting forms, occurs in the town of Greenfield, about a mile from the springs, and in the same vein with this we have also garnet, tourmaline, feldspar, mica, phosphate of lime, and perhaps spodumene. Some other minerals have been noticed as having been found in this county by Dr. Steele, to whom we are indebted for much information concerning its productions. These are,

Graphite, crystallized quartz, asbestus, calcareous spar, calcareous tufa, at the high rock spring, oolite,* coccolite, tremolite, steatite, alum in efflorescences, epidote, hornblende, iron and copper pyrites, and lignite.

SCHENECTADY COUNTY.

Very few minerals have hitherto been found in this county. The only useful one I believe is bog iron ore, of which there are some beds near the line between this and Albany. There are several localities of calcareous spar, one of which is particularly interesting, as this mineral constitutes the cement of a stratum of pebbles, and assumes the form of dodecahedral crystals. It has usually been called arragonite, but I doubt much whether it deserves to be ranked under that species.

These and a few inferior specimens of quartz and common jasper, are all the minerals at present credited to this county.

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* There is a bed of oolite about four miles north of Saratoga Springs. It is of a dark colour, and is made up of grains about as large as a pin's head. On analysis I found its composition to be as follows in 100 grains:

Carbonate of lime	95.00
Silica and alumica, with some carbonaceous matter	5.00

SCHOHARIE COUNTY.

In this fertile and well cultivated county, there are several minerals of great interest. The labors of the mineralogist and geologist are moreover greatly facilitated by the assistance of the Messrs Gebhard, who have so long and so well explored the rich field which is here presented to the student of nature. I can only repeat in this place my acknowledgments to those gentlemen, for their liberality and kindness in advancing the cause to which we are devoted.

If I were to characterize the mineralogy of Schoharie county by a single remark, it would be in reference to the number of caverns which it contains and the various forms of calcareous spar which these caverns exhibit. Stalactites and stalagmites are often found here of enormous size, and with a structure of great beauty. Ball's cave is the most celebrated on this account as well as of its extent, but there are many others within a circuit of a few miles, and probably more will hereafter be discovered.

In the immediate vicinity of Schoharie Court-House is a stratum of water limestone, which according to my analysis has the following composition, viz:

Carbonate of lime,	56.25
Carbonate of magnesia,	30.75
Silica and alumina,	11.50
Oxide of iron,	1.50

So that it does not differ essentially from the specimens obtained in Ulster county and elsewhere. A remarkable fact, connected with the water limestone at Schoharie, is the abundance of sulphate of barytes and carbonate of strontian which it contains. The latter mineral sometimes occurs massive when it resembles white marble, although much heavier. It is believed to be the only locality in the United States.

The sulphate of barytes, which is here also found in considerable abundance, is often mixed in various proportions, with the carbonates of lime and of strontian. Several new minerals have been described as from Schoharie, and I might perhaps have added others to the list; but careful observation constrains me to say that all these supposed new species are nothing more than mixtures of the various substances so abundantly diffused through the rocks in this vicinity. This remark, will, I think, especially apply to the Calstronbaryte of Shepard and the Emmonsite of Thomson. But more of this hereafter. It may, however be added here that many of these compounded minerals, and which exhibit cleavages, undergo changes by exposure, and they almost always effervesce in acids. This, together with the original mixtures of minerals, oblige us to discard chemical characters in the present instance as the ground of specific distinction.

An interesting locality of fibrous sulphate of barytes occurs in the town of Carlisle, about seven miles from the Court-House. The fibres are from half an inch to an inch and a half in width. This place was visited some years since by Prof. Eaton and he, I believe, first pointed out the true nature of the mineral. It is probably in considerable abundance and it has been proposed as a flux. Near the principal layer of sulphate of barytes there is another of the fibrous carbonate of lime, arragonite so called. And between these two extremes there are intermediate specimens, being mixtures of the two, in various proportions.

To the above forms of carbonate of lime, others may be added as occurring in this county, viz: calcareous tufa and agaric mineral, the last of which might, I should suppose, be used with advantage as a fertilizing agent. A specimen of it which I analyzed gave the following results, viz :

Carbonate of lime,	97.25
Organic matter,	1.95
Silica,	0.80

Several localities of bog iron ore are noticed here, but none of them are of much importance ; there is also a bed of oxide of manganese credited to this county, but I have not had an opportunity of examining it.

The frequent occurrence of those rounded masses, called septaria, is also to be remarked as one of the features in the mineralogy of Schoharie. They consist, as I have before stated, of an impure carbonate of lime with veins or partitions of sulphate of barytes or brown spar, running in various directions. They occur on the banks of the Schoharie creek, and are entirely similar in their appearance and in their mineralogical characters to those found on the shores of Lake Erie.

Of sulphur springs there are several in this county, one of which is in considerable repute, and is interesting in consequence of the depositions of sulphate of lime to which it gives rise. A chalybeate spring has also been found here.

Among the objects deserving the attention of the mineralogist, I should by no means omit the locality of iron pyrites in the vicinity of the Court-House. This mineral is so common that it would not be deserving of particular notice were it not for the interesting crystalline forms which it here presents.

The following minerals may also be added, as having been found in this county.

Anthracite—In small quantities, associated with calcareous spar.

Satin spar—In the caverns.

Fluor Spar—Near Schoharie. Rare.

Sulphate of iron and alum, in efflorescences.

Sulphate of strontian, probably several varieties—Near the Court-House.

SENECA COUNTY.

The mineralogy of this county is exceedingly limited. Of the useful minerals, we notice only some important beds of gypsum, near Seneca-Falls. These are extensively wrought, and large quantities of this valuable substance are sent from them to the west and south, by the Erie canal and by Seneca lake. The amount annually obtained from these beds is said to be 5,000 to 6,000 tons.

Petroleum is found floating on Seneca lake and on the surface of springs, and, as if to give colour to the opinion that it originates from coal, small quantities of that mineral are also found. There are some other mineral springs in this county, of which the most interesting is that described by Mr. Hall in his last report. It is a pool about twenty feet in diameter, near Canoga, and from it nitrogen gas is said to be constantly and abundantly evolved.

To the above it is only to be added, that a variegated marble occurs near Seneca lake, and hornstone or quartz is often found in the limestone.

STEUBEN COUNTY.

All that is known concerning the mineral resources of this county can be comprised in a single sentence, and it is, that it contains several sulphur springs and some beds of iron ore. I have not yet visited this county, and such is the short time still left for survey, that it is not probable that I shall add any thing further from personal examination.

SUFFOLK COUNTY.

The mineralogy of this county is of course similar to that of Kings and Queens. Thus it contains hematitic iron ore, but not in large and important beds. Iron pyrites and lignite are also associated with a white astringent clay, as on other parts of Long-Island, while magnetic iron sand and garnet sand are found along the whole sea shore. It is indeed so abundant in some places, especially after storms, that it may perhaps be collected for the purpose of reduction.

Salt is manufactured on some parts of the shore of Long-Island, by the exposure of sea water in shallow vats to the sun and wind.

SULLIVAN COUNTY.

Although the number of minerals in this county is not large, their localities are of considerable interest. I refer particularly to the mines of lead ore which have recently been opened in the vicinity of Wurtzboro'. Besides galena, or sulphuret of lead, there are crystallized iron and copper pyrites and the sulphuret of zinc, or blende, and these metallic minerals are contained in a gangue of quartz, which is often in handsome crystals. These mines and their products were particularly noticed in my last report, and I then expressed some doubts whether they could be advantageously wrought, on account of the difficulty of separating the copper, zinc and iron from the lead. I have been informed that during the last summer large quantities of the ore were raised, and that the difficulties which attended the reduction of it have been overcome. If this be correct, and if the vein of ore continues of its present width, the location of the principal mine on the immediate bank of the Hudson and Delaware canal is such as to give it great importance.

TIOGA COUNTY.

In this county I have to notice only the occurrence of some sulphur springs, and a bed of marl in the town of Spencer, from which lime is made by calcination.

TOMPKINS COUNTY.

Scarcely more abundantly supplied with minerals than the preceding, at least so far as my information extends. Calcareous tufa is found in considerable quantities near the village of Ithaca, investing moss, &c. as in many other parts of the State. There are also beds of gypsum in the calciferous slate, but I have no means of knowing their value. To these may be added two or three sulphur springs.

ULSTER COUNTY.

Although the mineral productions of this county are not numerous, a few of them are of great importance. This is particularly the case with the water limestone, of which immense deposits are found along the Rondout and the Hudson and Delaware canal. Some account of the operations in this article was given in my last annual report, and I now add with regret, that the discontinuance of many of our public works has seriously affected this important branch of industry.

In the vicinity of the High falls there is a soft argillaceous limestone, which, as it may be easily reduced to powder, has been proposed as a fertilizing agent. Its composition is similar to that of the water limestone, with which it is no doubt associated. An analysis gave the following results :

Carbonate of lime,	29.45
Carbonate of magnesia,	24.30
Silica and alumina,	42.50
Oxide of iron,	3.75

This limestone often contains cubical and dodecahedral crystals of iron pyrites, similar to those found in the county of Schoharie.

Of marl, there are several localities in Ulster,* while the other more common forms of carbonate of lime are also abundant ; as for example calcareous spar and stalactites, the latter of which has been found in a cavern fourteen miles south-west from Esopus. It deserves also to be stated, that fossil bones have been obtained from the marl beds of this county.

Lead ore has long been known to occur in the Shawangunk mountains, within the limits of Ulster, and mining operations have recently been commenced near the red bridge, which forms the boundary be-

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* A specimen of marl from Judge Hasbrouk's farm, near Kingston, having a greyish colour and containing shells, is composed in 100 parts, of

Silica and alumina,	3.25
Vegetable matter,	4.00
Carbonate of lime,	92.75

tween the counties of Ulster and Sullivan, on the Hudson and Delaware canal. Hitherto, however, these have not been attended with much success. The ore is indeed found, and with the same associates as at Wurtzboro', but in much less quantity. Some of the specimens of crytallized quartz obtained during the progress of these works are of great beauty.

There is a sulphur spring at New-Paltz, which has within the last year excited some attention, and much is said concerning its medicinal properties. I have not yet had an opportunity of analyzing its waters.

In addition to the above notices of the mineral productions of this county, it may be observed that there have been found in it, thin seams of coal, the appearances of which were so promising as to induce large expenditures in boring. Alum also occurs in several places as an efflorescence arising from the action of decomposing iron pyrites upon certain clays. Graphite in small quantities is occasionally observed.

WARREN COUNTY.

This is situated in the great mineral region, and when properly ex plored it will no doubt be found to possess resources fully equal to those of the more northern counties.

Of iron ore there are in Warren county, numerous and important localities, embracing both the magnetic oxide and the hematite. Marl has also been found in Queensbury, and here too, as in many other places, it is associated with peat which is no less valuable than the preceeding.

Graphite, resembling that from the celebrated locality at Ticonderoga, is said to occur in workable beds in the towns of Johnsburgh and Athol. Porcelain clay has also been found in this county, which has been pronounced to be of good quality by those who are fully competent to decide in regard to such matters. Besides these, there are valuable beds of marble.

To the mineralogist, Warren county is one of great interest, and if the catalogue of its minerals is not extensive, we are to recollect that it has been but partially explored. The following are credited to it, in addition to those already noticed:

Crystallized quartz—Formerly abundant at Diamond island, in Lake George, and presenting some rare forms.

Calcareous spar—Associated with the preceeding, and at other places.

Calcedony and Hornstone—Abundant.

Feldspar, in large cleavages. Near Caldwell.

Tourmaline, often in large crystals. With the preceding.

Garnet—Near Ticonderoga.

Labradorite—In bowlders, in Warrensburgh.

Epidote—Banks of Lake George.

Sphene—Lake George.

Ankerite, or the carbonate of iron, &c.

Tremolite—Johnsburgh.

WASHINGTON COUNTY.

In this county we have several useful mineral productions. Iron ore both of the magnetic and hematitic kinds, have been found in it. Of marl and calcareous tufa there are also localities enumerated, and there is abundance of good marble. Calcareous spar in the crystalline form is every where found in the fissures of the limestone and slate.

Small quantities of galena were formerly obtained at White creek, but I believe no regular vein of the ore has been discovered, and no attempts have been made at mining.

WAYNE COUNTY.

The mineralogy of this county is quite similar to that of several of the western counties. There is here a most valuable deposit of the lenticular iron ore, which is quarried in large quantities and used in several furnaces. Besides this, bog iron ore has been found in considerable abundance near Lockville.

With gypsum, marl, gypseous marl and water limestone, Wayne county is well supplied. Sulphur springs also abound, and weak brine springs have been found. An interesting one belonging to the latter class occurs near Clyde, where a boring to the depth of 400 feet was made by a company in 1832. Salt water was obtained in small quantity but having considerable strength. What rendered this boring more worthy of notice was, that inflammable gas was discharged similar to that given out in other places in connexion with brine.

The brine springs of this county were at one time of considerable importance, especially those of Galen; where in 1810 about 50,000 bushels of salt were manufactured. But these works have long since ceased, in consequence of their vicinity to the more important springs of Onondaga.

WESTCHESTER COUNTY.

This county furnishes an extensive list of minerals. Among the most important, in an economical point of view, may be ranked the dolomitic marble, which occurs abundantly in various places, and is extensively employed as a building material.

Of iron ore, some localities occur near Tarrytown and Sing-Sing, but it has not yet been found in such abundance as to warrant extensive operations.

In the vicinity of Sing-Sing, mining operations were formerly carried on to a considerable extent, under the flattering idea that silver ore existed there. Singular stories are related of the occurrence of this ore, and native silver has been credited to this place, in some mineralogical works. We have at present no means of arriving at the truth. Galena has been obtained here in small specimens, and it is more than probable that this may have been mistaken for silver ore. Several ores of copper have been found in the same vicinity, as copper pyrites, black sulphuret of copper, and green carbonate of copper. And to these may be added iron pyrites, sulphuret of zinc and oxide of manganese, which occasionally occur in the limestone.

Of sulphur springs, there is one near Sing-Sing which has acquired some celebrity.

Like the counties of Putnam and Richmond, Westchester contains beds of serpentine, with which are associated other magnesian minerals. The serpentine, although often of a beautiful colour, and susceptible of a fine polish, can seldom be procured in blocks of sufficient size for any useful purpose.

The following is a list of the remaining minerals of this county:

Calcareous spar, the *cuboide* of Hauy—Near Sing-Sing. Other forms, elsewhere.

Sulphate of barytes—Anthony's Nose, near the line of Putnam county.

Phosphate of lime—With the preceding.

Hydrate of magnesia and carbonate of magnesia, compact and crystalline. Found, according to Mr. Mather, at New-Rochelle.

Quartz, drusy, calcedony, agate and jasper—New-Rochelle.

Serpentine, almost every variety—New-Rochelle.

Pyroxene—every where in the dolomite.

Hornblende—Near Verplanck and elsewhere. Actynolite, tremolite and asbestus are also common.

Hydrous anthophyllite—White-Plains? *Mather.*

Feldspar—Several localities, especially near Tarrytown.

Stilbite—West-Farms.

Garnet—On the Croton river.

Epidote—Peekskill.

Chlorite—Rye.

Tourmaline, in long slender crystals—Rye.

Vauquelinite—Near Sing-Sing. *Dr. Torrey.*

Magnetic pyrites—Sparta and Sing-Sing.

Chromate of iron—New-Rochelle.

Magnetic oxide of iron—In serpentine beds, with the preceding.

Red ochre and red chalk—Cortlandtown.

Sphene—Said to have been found near Peekskill, in an aggregate of quartz.

YATES COUNTY.

I have no information concerning the mineral productions of this county. A gas spring is credited to it; and it deserves to be mentioned that a mass of native iron was some years since found on the surface of the earth, in the town of Penn-Yan. It was probably of meteoric origin, although, according to the analysis of Mr. Clemson, it contained no nickel.

Such is a condensed account of the mineralogy of the several counties in the State, and a summary of the materials which have been collected for illustrating this department of the survey. Although there can be no doubt that many discoveries will hereafter be made, we have already evidence enough to satisfy us that, much as New-York may depend upon agriculture and commerce, her mineral resources must form an important element of her future greatness.

I have the honor to be
Your obed't serv't,
LEWIS C. BECK.

December 26th, 1839.

APPENDIX

To the Report from the Mineralogical and Chemical Department, containing notices of some rare or interesting minerals recently found in the State of New-York.

Brown Spar, or Ankerite.

This mineral was found by Dr. Emmons in Johnsburgh, in the county of Warren. The same or a similar species also occurs at the Parish ore bed, in St. Lawrence. Colour, reddish-brown. Primary form, a rhombohedron. The angle is about 106°, but the faces of the crystals are sometimes curved.

Hardness, about 3.5. Specific gravity, 2.881.

Before the blowpipe it decrepitates, but at length becomes of darker colour and is slightly attracted by the magnet. Soluble with effervescence in dilute muriatic acid. An analysis of a specimen received from Dr. Emmons, gave the following results, in 100 grains:

Carbonic acid,	45.00
Lime,	28.00
Magnesia,	13.75
Protoxide of iron,	11.25
Moisture and loss,	2.00

Except in the absence of a small proportion of manganese, the above composition is quite similar to that of the ankerite by Berthier.*

Fibrous Phosphate of Lime.

This mineral was described by Dr. Emmons, in the second annual report of the survey, under the name of *Eupyrchroite.*

It occurs in thin mammilated layers, which are fibrous, Colour, pale green, sometimes passing into brown. Dull and opaque. Specific gravity, 3.06. Hardness, = 4.

Having ascertained the nature of this mineral, I dissolved a weighed portion in muriatic acid, and to the solution added sulphuric acid. I next added alcohol; threw the whole on a filter, and washed the resulting sulphate with the same liquid. From the weight of the sulphate of lime, after ignition, I deduced that of the phosphate of lime in the mineral. From the filtered liquor, after the addition of water, the oxide of iron was thrown down by ammonia. The following are the results, viz :

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* Traité des Essais par la voie Séche, I. 494.

Phosphate of lime,	92.85
Oxide of iron, with a little alumina,	5.20
Silica, (foreign,)	0.50
Moisture,	1.25
Fluoric acid,	trace.

The oxide of iron, silica and alumina, are undoubtedly accidental ingredients, and the mineral is therefore a phosphate of lime, although in a rare form. It was found near Crown Point, in Essex county.

The presence of fluoric acid in the phosphate of lime, may be shown by reducing it to powder, and then mixing sulphuric acid with it, in a platinum crucible. Upon covering the crucible with a plate of glass, and applying a gentle heat, the glass is soon corroded. In this way I have detected the presence of fluoric acid in the crystallized phosphate of lime in Orange county, and also in that from Rossie, St. Lawrence county. A very slight effect only was produced, when the fibrous variety was thus operated upon.

Pyroxenic Steatite.

This substance was described by Dr. Emmons, in the first report of the survey, under the name of *Rensselaerite.* His description is as follows :

Hardness, = 3.5 or 4.0. Specific gravity, 2.874. Form, oblique rhombic prism. M on M = 94° and 86° ; P on M = 106° 30′.—Cleavage parallel to P. Colour, white, yellowish-white, or dark slate. Fracture uneven. Corresponding varieties somewhat granular. Individuals strongly coherent. Before the blowpipe, it fuses with difficulty into a white enamel ; moistened with nitrate of cobalt, it assumes a pale flesh red colour.

Dr. Emmons furnished me with specimens of the above mineral from Canton, in St. Lawrence county, more than a year ago. During the last summer, Dr. Horton and myself found it in great abundance near Oxbow, Jefferson county, at Governeur, St. Lawrence county, and elsewhere.

My examination of this substance was conducted according to the usual process for the analysis of minerals not decomposable by acids. The following are the results :

Silica,	59.75
Magnesia,	32.90
Lime,	1.10
Peroxide of iron,	3.40
Water,	2.85

The composition, therefore, agrees very well with that of steatite. In regard to its crystalline character, it is similar to the steatitic pyroxenes of Sahla, noticed by Beudant, which contain from 30 to 60 per cent of foreign matters, but which still have the form and cleavage of pyroxene. Rose has analyzed three varieties, the composition of one of which is as follows :

Silica,	58.30
Lime,	9.98
Magnesia,	24.22
Protoxide of iron,	4.24
Oxide of manganese,	0.68
Alumina,	0.11
Water,	3.11*

The other varieties have a somewhat different composition. But they all serve to show how a mixture of pyroxene may impress its crystalline character upon the steatite. We obtained numerous varieties of this substance, both in colour and structure, and it is probable that all these would exhibit some slight differences in chemical composition.

Schiller spar, or metalloidal diallage.

As there is some confusion in regard to the above names, it is proper to state that the mineral about to be noticed is identical with the schiller spar of Dr. Thomson.†

Colour dark green, almost blackish green. Fracture uneven, splintery. Sectile. Specific gravity 2.746. It is in broad foliated masses which cleave in two directions, and apparently have the primary form of a rhombohedron. The lamina slightly curved. One of the cleavages is easily obtained and has a metallic pearly lustre, and a pinchback brown colour. Hardness about the same as that of serpentine. Powder yellowish grey. Where the mineral has been exposed to the air, it is of a tombac brown colour.

Thin fragments treated by the blow pipe are merely rounded on the edges, but become of the same brown colour as when they have been long exposed to the air, and are attracted by the magnet. With borax it is fusible, though with difficulty, and the glass when cold has a greenish colour.

This mineral is found associated with dark coloured common serpentine at Brown's quarry, near Carmel, Putnam county. Its composition is no doubt influenced by its contact with the latter substance.

Allanite.

This interesting mineral now for the first time, I believe, credited to the United States, has been found in Warwick, Orange county. The specimen which I received from Dr. Horton has the following characters.

Massive, although it has the appearance of being part of a crystal. Colour, brownish-black. Dull on the outside, but the fresh fracture has a resinous or imperfectly metallic lustre. Powder brown. Opaque or feebly translucent, on thin edges. Very brittle. Fracture uneven or small conchoidal. Hardness about 6.0. Specific gravity 3.635.

Before the blowpipe it melts with effervescence into a black shining glass. With borax it melts easily into a dark green glass. It gelatinizes with heated muriatic acid. The solution causes an abundant precipitate with ammonia.

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* Beudant, Traité Elémentaire de Minéralogie, II. 224.

† Outlines of Mineralogy and Chemical Analysis, I. 173.

The details of my analysis I shall shortly present elsewhere. The following are the results:

Silica,	30.50
Alumina,	11.25
Protoxide of iron,	22.27
Protoxide of cerium,	24.90
Lime,	9.87*

Cacoxene or Cacoxenite.

This mineral, heretofore found only in the iron mines at Hrbeck, in Bohemia, was obtained during the last summer in an iron mine in the town of Antwerp, Jefferson county, where it was first noticed by Mr. Vanuxem.

It occurs in minute radiated tufts on the surface of the compact specular iron, or rather in seams in the ore. The crystals or blades are arranged in diverging groups, radiating from a centre. Colour, when fresh, yellow; but the surface becomes brown and somewhat pulverulent on exposure. The lustre of the blades is silky, or approaching to metallic, soft and sectile. Infusible by the blowpipe, but when acted on by it, it becomes of a brownish colour, and is then attracted by the magnet. With borax it fuses into a dark coloured glass.

Karpholite, the mineral which this most resembles, is fusible and does not become magnetic.

Cacoxenite is essentially composed of phosphoric acid and peroxide of iron. The name which it bears has been given to it in consequence of its presence being injurious to the iron ore.

Tabular Spar.

The specimens of this mineral, from a new locality in Diana, Lewis county, were apparently so pure, that I was induced to examine one of them with great care. It has a snow-white colour, foliated structure, and a high vitreous lustre. It is semi-transparent, and closely resembles some varieties of tremolite. Specific gravity, 2.937, which is a little higher than that of specimens from other localities. The following are the results of my analysis, in 100 parts, viz.

Silica,	51.90
Lime.	47.55
Oxide of iron,	0.25

This approaches very nearly to its true atomic construction. The mineral at the above locality is associated with green coccolite, but pure specimens of considerable size may be obtained.

Stellite.

This is the name given by Dr. Thomson to a mineral found in the rifts of a greenstone rock situated on the banks of the Forth and Clyde canal, in Scotland.† I have found specimens which agree in the most important characters with that described by Dr. Thomson in the fissures of the greenstone at Bergen-Hill, New-Jersey, and at Tappan Slote, Rockland county. Our mineral, however, as we shall presently see, differs somewhat in its chemical composition. The following is the description:

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* This approaches very nearly to the composition of the *cerite* of Hisinger and Berzelius, found at Bastnaes, near Riddarhytta, in Sweden. This, however, is now generally supposed to be identical with the allanite from Greenland. (*See Beudant, Philips and Shepard.*) Dr. Thomson's cerite is entirely distinct from the preceding.

† Outlines of Mineralogy, Geology, &c. I. 313.

Colour, snow-white. It consists of a congeries of crystals radiating from various centres, which run into each other in a confused manner. When these bundles are broken up, they separate into needle-form crystals, which are exceedingly sharp. These needles are tough, and when subjected to the pestle appear like amianthus. Their shape cannot be determined, but they appear to be four sided prisms. Lustre, silky, shining. Translucent. Hardness, about 3.0. Specific gravity of a very closely aggregated specimen, 2.836.

Before the blow-pipe, our mineral fuses readily, even when in quite large fragments, and with slight bubbling into a beautiful white enamel. With borax it melts into a transparent glass. It gelatinizes with muriatic acid. When heated to redness in a crucible, it is partially fused. The following is its composition in 100 grains, according to my analysis, viz.

Silica,	54.60
Lime,	33.65
Magnesia,	6.80
Oxide of iron, with a little alumina,	0.50
Water and carbonic acid,	3.20

Our mineral differs from the stellite of Dr. Thomson, in its containing less alumina, oxide of iron and water. But these may after all be accidental ingredients. It must be confessed, however, that both of them bear a close resemblance in their characters to Wollastonite, except that the latter contains soda as one of its constituents, though in small quantity. But from all my experiments upon this mineral, I am inclined to believe that it belongs to the family of zeolites; and if so, the only one with which it agrees is that above mentioned.

Mr. Dana in his Mineralogy remarks, that the stellite of Dr. Thomson is closely allied to the natrolite; but the small proportion of alumina which it contains, and perhaps its entire absence in pure specimens, must keep it totally distinct from that, and indeed from all other minerals of the zeolite family.

REPORT

Of Dr. Torrey, on the Botanical Department of the Survey.

To His Excellency, William H. Seward,
Governor of the State of New-York.

Sir:

As Botanist under the act for a Geological Survey of the State, I present you with the following catalogue, preparatory to my final report on the department committed to my charge. When I received my commission, no specific duties were assigned to me, except to make a thorough examination of the vegetable productions of the State, to collect and preserve seven sets of each species, and to arrange and name the whole. One of the sets was to be put up in volumes, for reference, and deposited in the Capitol at Albany; the others to be placed at the disposal of the Executive.

In compliance with these instructions, I have made numerous journeys in various parts of the State, and have prepared extensive collections of botanical specimens. I have also been greatly aided by several botanical friends, particularly by Dr. Asa Gray, who has devoted much time to the study of the plants of New-York, Dr. Peter D. Knieskern of Oriskany, and Dr. H. P. Sartwell of Penn-Yan. I am likewise indebted to many other botanists and naturalists for the communication of specimens, or localities of rare or interesting plants, among whom I take pleasure in naming Prof. Bailey of West-Point; I. Carey, Esq. of New-York; Dr. Hadley of Fairfield; Dr. Bradley of Greece; Dr. Emmons and Prof. Hall, of the geological corps, and Prof. Dewey of Rochester. I have also availed myself of information formerly received from many other botanists who have explored various parts of the State. To Dr. Crawe, I am indebted for some rare species from St. Lawrence and Jefferson counties; to Dr. Barratt, for valuable observations on the plants of the Highlands of New-York; to Dr. Aiken, for specimens and remarks on the plants of the central parts of the State; to Prof. Eaton, the late Mr. H. H. Eaton, and Dr. Wright, for information relating to the botany of Rensselaer county; to Drs. L. C. Beck and Eights, for rare plants of Albany county and other parts of the State, and to Dr. Matthew Stevenson for a catalogue of the plants of Washington county, as well as for many valuable specimens. Other friends whose names appear in the following pages have rendered valuable assistance.

Although so much has been accomplished towards the preparation of a Flora of the State, it is not pretended that all the plants within our limits are yet discovered. Many interesting districts have not been visited, and even in those which have been most examined, new plants are not unfrequently found. A considerable number of species are extremely limited in their geographical range, and others disappear soon after flowering, so that unless a district be visited several times in a season, many plants may be overlooked.

The State of New-York is an interesting botanical region. The geographical range of plants being limited by the characters of the soil and rocks, as well as by temperature, and the geological features of the State being greatly diversified, our Flora contains a considerable number of genera and species that are not found in some of the neighboring districts. The extended tertiary and alluvial formations of Long-Island, afford many plants peculiar to this portion of the State, besides the species that are confined to the immediate neighborhood of the sea. Our primitive formation yields a great proportion of the species inhabiting the New-England States. In the central and western counties where transition-rocks abound, we find many plants of Ohio, Indiana, and the country bordering Lake Superior, while on the lofty mountains of Essex county a true alpine vegetation exists.

The whole number of species indigenous and naturalized in our State, including the lower orders of the cryptogamia, probably exceeds 2,400 species. It is however the phenogamous or flowering plants that have chiefly occupied my attention, although I have not neglected the cryptogamia tribes with the exception of the fungi, which are so perishable that few of them can be preserved for reference. Of phenogamous or flowering plants 1,350 species have been found within the limits of the State, and of ferns and plants allied to them, 53 species. The mosses have not yet been carefully studied, but many specimens of them are preserved in my collection, and the number of them belonging to the State is estimated at 150. Of hepaticæ and characeæ we have 30 species. The lichens are more than 150, and the number of fungi in the State is at least 300. The interesting tribe of the algæ includes a considerable number of species which are now receiving the special attention of Prof. Bailey of West-Point, from whom I expect to receive an account of them to annex to my final report.

Of the flowering plants already discovered in the State, 277 are trees or shrubs, 150 are reputed to possess medical properties, 250 are ornamental herbaceous species, and 140 are plants which have been introduced from other countries, and are now naturalized in our soil. Of proper grasses, our Flora contains 116 species, 24 of which are of foreign origin. In the nearly allied tribe of the sedges, there are 140 species, more than half of which belong to the genus carex.

The following catalogue, embracing all the flowering plants and ferns hitherto detected in the State, is arranged according to the natural method. Only such synonyms are added as seemed necessary for distinguishing the species with certainty. I have also recorded the locality, general or special, of each plant, together with the time of flowering, popular names, and occasionally some remarks. The species that are believed to be naturalized, have the mark (§) placed before them.

It is my purpose in my final report to prepare full descriptions of all these plants, in as popular language as the subject will admit of, with particular attention to their economical and medicinal uses. It is desirable, however, before the publication of this report, to render our list of native plants as complete as possible, and it is my earnest desire that every botanist in the State, who may receive this catalogue, will communicate to me any species not herein enumerated. Localities of rare plants, and remarks on such as are useful, injurious or obscure, will enable me to prepare a more complete, and therefore more useful Flora, than I could give by my unassisted labors. I shall feel greatly obliged for local catalogues of plants, drawn up somewhat after the manner of the present list, with the precise time of flowering, and the period when the fruit or seed ripens. When there is any doubt as to the names of plants, dried specimens, with numbers annexed, can be sent to me for examination. It will always afford me pleasure to receive collections from any part of the State, and to name the plants which they contain.

In some cases, it will be well, in order to exhibit the natural appearance and colour of the flower and other parts, to send drawings of the plants, made from nature. Specimens and descriptions of medicinal plants, are particularly desired, with an account of their virtues and popular use. Also information respecting the various kinds of timber trees, the quantity, quality and uses of each species ; notices of weeds and other injurious plants, with the best modes of eradicating them ; and, in a word, any interesting facts relating to the economical or scientific botany of the State, will be thankfully received.

JOHN TORREY.

CATALOGUE OF PLANTS.

CLASS I. EXOGENS, OR MONOCOTYLEDONOUS PLANTS.

ORDER RANUNCULACEÆ. THE CROWFOOT TRIBE.

CLEMATIS, *Linn.* *Virgin's Bower.*
- ochroleuca, *Ait.* Long Island, near New-York. June.
- virginiana, *L.* *Common Virgin's Bower.* Hills and copses. Aug.
- verticillaris, *D. C.* Rocky places. April–May.

ANEMONE, *L.* *Wind Flower.*
- nemorosa, *L.* Woods. April–May.
- cylindrica, *Gray.* Western part of the State. May–June.
- virginiana, *L.* Rocky woods, &c. July.
- multifida, *D. C.* Var. hudsoniana, *D. C.* Watertown, Jefferson county, *Dr. Crawe.* June. The only known locality of this plant in the State.
- pennsylvanica, *L.* Rocky places, near streams. June–July.

HEPATICA, *Dill.* *Liver-leaf, Liver-wort.*
- triloba, *Chaix.* Woods. March–April.

RANUNCULUS, *L.* *Crowfoot.*
- aquatilis, *L.* Var. capillaceus, *D. C.* Ponds and small streams. June–August.
- flammula, *L.* Inundated places. July–August.
- reptans, *L.* Borders of lakes and rivers, north and west of Albany. June–August.
- pusillus, *Poir.* Boggy places, near New-York, and on Long Island. July.
- cymbalaria, *Pursh.* Salt marshes along the seacoast of New-Jersey, and at Salina. August.

RANUNCULUS, (continued.)
abortivus, *L.* Rocky woods. April–June.
sceleratus, *L.* Ditches and overflowed places. June–August.
Purshii, *Richardson.* R. multifidus, *Pursh.* R. lacustris, *Beck & Tracy.* Ponds and wet places. May–July.
acris, *L.* *Buttercups.* Meadows and pastures. June.
repens, *L.* R. Clintonii, *Beck.* R. intermedius, *Eaton.* Wet shady places. May–July.
pennsylvanicus, *L.* Wet places, rare. June–August.
recurvatus, *Poir.* Shady places, in rich soils. May–June.
fascicularis, *Muhl.* Rocky woods. April–May.
bulbosus, *L.* *Common Buttercups.* May. Introduced.

CALTHA, *L.* *Marsh Marigold.*
palustris, *L.* Swamps. April–May.
Var. integerrima, *Torr. & Gr.* C. integerrima, *Pursh.* Near Peekskill. *Dr. Crandell.*

TROLLIUS, *L.* *Globe Flower.*
laxus, *Salisb.* Sphagnous swamps, western part of the State. May.

COPTIS, *Salisb.* *Gold Thread.*
trifolia, *Salisb.* Swamps. May–June.

AQUILEGIA, *L.* *Columbine.*
canadensis, *L.* Rocks. May–July.

DELPHINIUM, *L.* *Larkspur.*
§ consolida, *L.* *Common Larkspur.* Fields and road sides. July.

ACONITUM, *L.* *Monkshood.*
uncinatum, *L.* Mountains, in wet places, Chenango county. *Major I. Le Conte.* This plant has not been found within the limits of this State, since it was discovered by Maj. Le Conte.

ACTÆA, *L.*
alba, *Bigel.* *Baneberry, White Cohosh.* Rocky woods. May.
rubra, *Bigel.* *Red Cohosh.* Rocky Woods. May.

CIMICIFUGA, *L.* *Bugbane.*
racemosa, *Ell.* Actæa racemosa, *L.* *Blacksnake-root.* Dry woods. July.

THALICTRUM, *L.* *Meadow Rue.*
dioicum, *L.* Rocky woods. April–May.
cornuti, *L.* Wet meadows. June–July.
anemonoides, *Michx.* Woods, in rich soils. April–May

ORDER MAGNOLIACEÆ. THE MAGNOLIA TRIBE.

MAGNOLIA, *L.*
glauca, *L.* *Sweet Bay.* Swamps, Long Island. Not found elsewhere in the State. May–June.
acuminata, *L.* *Cucumber Tree.* Lewiston and Portage, *Dr. Sartwell.* Also in Cattaraugus, where it is a tall tree with a trunk often more than four feet in diameter. *Prof. I. Hall.*
umbrella, *Lam.* *Umbrella Tree.* "Northern part of the State of New-York." *Michaux.* No other botanist has found this tree within the limits of this State.

LIRIODENDRON, *L.* *Tulip Tree.*
tulipifera, *L.* *White-wood.* Woods. May–June.

ORDER MENISPERMACEÆ. THE MOONSEED TRIBE.

MENISPERMUM, *L.* *Moonseed.*
canadense, *L.* Banks of rivers and thickets. June–July.

ORDER BERBERIDACEÆ. THE BARBERRY TRIBE.

BERBERIS, *L.*
§ vulgaris, *L.* *Barberry Bush.* Hedges, fields. Not found far in the interior.

LEONTICE, *L.*
thalictroides, *L.* *Blue Cohosh.* Woods. April.

JEFFERSONIA, *Bart.* *Twin-leaf.*
diphylla, *Pers.* Rich calcareous, northern and western parts of the State. April.

PODOPHYLLUM, *L.* *May Apple.*
peltatum, *L.* Woods and meadows. May.

ORDER CABOMBACEÆ. THE WATER-SHIELD TRIBE.

BRASENIA, *Schreb.* *Water Shield.*
peltata, *Pursh.* Floating in still water. July.

ORDER CERATOPHYLLACEÆ.

CERATOPHYLLUM, *L.* *Hornwort.*
echinatum, *Gray.* In ponds, or slow-flowing water. August.

ORDER NELUMBIACEÆ.

NELUMBIUM, *Juss.*
luteum, *Willd.* *Great Yellow Water Lily.* Sodus Bay, Lake Ontario. *Dr. Sartwell.* June.

ORDER NYMPHÆACEÆ. THE WATER-LILY TRIBE.

NYMPHÆA, *Tourn.* *White Water Lily.*
odorata, *Ait.* In water. June–September.

NUPHAR, *Smith.* *Yellow Pond Lily.*
lutea. Var. Kalmiana, *Torr. & Gr.* N. Kalmiana, *Pursh.* In water. June.
advena, *Ait.* *Spatterdock.* In water. June–August.

ORDER SARRACENIACEÆ.

SARRACENIA, *L.* *Sidesaddle Flower.*
purpurea, *L.* Swamps. May–June.
Var. heterophylla. S. heterophylla, *Eaton.* Junius, Seneca county. *Dr. Sartwell.* The flowers of this variety are of a dull yellow colour, and the leaves are somewhat different from those of the ordinary form; but the plant does not appear to be a distinct species.

ORDER PAPAVERACEÆ. THE POPPY TRIBE.

SANGUINARIA, *L.* *Blood-root.*
canadensis, *L.* Open woods. March–April.

CHELIDONIUM, *L.* *Celandine.*
§ majus, *L.* Waste grounds, and along fences. May–October.

ORDER FUMARIACEÆ. THE FUMITORY TRIBE.

DIELYTRA, *Borkh.*
cucullaria, *D. C.* *Breeches Flower.* Shady woods, in rich soil. April.
canadensis, *D. C.* *Squirrel Corn.* Rocky woods. April.
eximia, *D. C.* Fumaria eximia, *Ker.* D. formosa, *T. & G.* not of *D. C.* nor Fumaria formosa, *Andr.* Corydalis formosa, *Pursh.* Yates county. *Dr. Sartwell.*

ADLUMIA, *Raf.*
cirrhosa, *Raf.* *Climbing Fumaria.* Shady rocks. July–Sept.

CORYDALIS, *D. C.*
aurea, *Willd.* Rocky woods. April–August.
glauca, *Pursh.* Rocky places. May–July.

FUMARIA, *L.* *Fumitory.*
§ officinalis, *L.* Fields and cultivated grounds. May–August.

ORDER CRUCIFERÆ. THE CRUCIFEROUS TRIBE.

NASTURTIUM, *R. Br.*
palustre, *D. C.* Wet places. June–August.
hispidum, *D. C.* Wet places. Highlands of New-York. *Dr. Barratt.*
natans. Var. americanum, *Gray.* Oneida lake, *Dr. Gray.* Ogdensburgh, *Dr. Crawe.* July.

BARBAREA, *R. Br.*
vulgaris, *R. Br.* *Winter Cress.* Along streams, and road sides. May–June.

TURRITIS, *Dill.* *Tower Mustard.*
glabra, var. *Torr. & Gr.* Rocks, Watertown. *Dr. Crawe.*

ARABIS, *L.* *Wall Cress.*
hirsuta, *Scop.* Rocky places. Rare.
lyrata, *L.* Rocks. April–May.
lævigata, *D. C.* Rocky woods, and along rivers. May.
canadensis, *L.* With the preceding. June–July.

CARDAMINE, *L.*

rotundifolia, *Michx.* C. rhomboidea, *D. C.* Wet meadows, and about shady springs. April–May.

pratensis, *L.* *Cuckoo Flower.* Swamps, western part of the State. April–May.

hirsuta, *L.* C. pennsylvanica, *Muhl.* C. virginica, *L.* Wet places, and on rocks. May–June.

DENTARIA, *L.* *Toothwort.*

laciniata, *Muhl.* Rich shady soils. April–May.

maxima, *Nutt.* Western part of the State. *Nuttall.* I have never found this plant, nor has it been observed by any other botanist save its discoverer.

diphylla, *Michx.* *Pepper Root.* Rich shady soils. April–May.

SISYMBRIUM, *Allioni.*

§ officinale, *Scop.* *Hedge Mustard.* Road sides, &c. May–August.

thaliana, *Gay.* Rocks and sandy fields. May.

ERYSIMUM, *L.* *Hedge Mustard.*

cheiranthoides, *L.* Along streams, in the interior of the State. July–August.

SINAPIS, *L.* *Mustard.*

§ nigra, *L.* *Black Mustard,* Fields and waste places. June–August.

§ arvensis, *L.* Wet meadows and fields. Common in the interior of the State. Called *Wild Mustard,* and *Charlock.*

DRABA, *L.*

arabisans, *Michx.* On rocks along the borders of lakes in the northern part of the State. May.

caroliniana, *Walt.* Sandy fields near New-York. April–June.

verna, *L.* *Whitlow Grass.* Fields and hill sides. March–April.

CAMELINA, *Crantz.* *Gold of Pleasure.*

§ sativa, *Crantz.* Fields and cultivated grounds. May–June.

THLASPI, *Dill.*

§ arvense, *L.* New-York. June–July. *Pursh.* I have not found this plant within the limits of the State.

LEPIDIUM, *L.* *Pepper-wort.*

§ campestre, *L.* Waste places. June–July.
virginicum, *L.* Fields and road sides. June–August.

CAPSELLA, *Vent.* *Shepherd's Purse.*

§ bursa-pastoris, *Mœnch.* Fields and waste places. May–Sept.

CAKILE, *Tourn.*

maritima, *Scop.* *Sea Rocket.* Seashore of Long Island. July–August.

ORDER CAPPARIDACEÆ. THE CAPER TRIBE.

POLANISIA, *Raf.*

graveolens, *Raf.* Gravelly banks of rivers and lakes. June–August.

ORDER POLYGALACEÆ. THE MILKWORT TRIBE.

POLYGALA, *Tourn.* *Milkwort.*

sanguinea, *L.* P. purpurea, *Nutt.* Fields and meadows. July–September.
cruciata, *L.* Sphagnous swamps. August–September.
verticillata, *L.* Dry sandy soils. June–October.
senega, *L.* *Seneca Snake-root.* Dry rocky woods. May–June.
polygama, *Walt.* Sandy fields and woods. June–July.
paucifolia, *Willd.* Sphagnous swamps. May.
Var. alba. Sand plains near Albany. *Dr. J. Eights.*

ORDER VIOLACEÆ. THE VIOLET TRIBE.

VIOLA, *L.* *Violet.*

pedata, *L.* Dry sandy woods. May–June.
palmata, *L.* Low grounds. May.
cucullata, *Ait.* Fields and woods, in damp soils. April–May.
Selkirkii, *Goldie.* Woody hill sides, western part of the State.
sagittata, *Ait.* V. primulifolia, *Pursh,* not of *L.* Hills and fields. April–May.
rotundifolia, *Michx.* Shady rocky woods. May.
blanda, *Willd.* Wet meadows. April–May.
primulæfolia, *L.* Wet meadows. April–June.
lanceolata, *L.* Wet meadows and swamps. April–May.

Viola, (continued.)
striata, *Ait.* Wet meadows. April–May.
Muhlenbergii, *Torr.* Swamps and shady woods. April–May.
rostrata, *Pursh.* Moist rocky places. May.
pubescens, *Ait.* Dry woods. April–May.
canadensis, *L.* Shady woods. May–July.
tricolor. Var. arvensis, *D. C.* Dry hills. May.

Solea, *Ging.*
concolor, *Ging.* Wet shady woods; western part of the State. April–May.

Order DROSERACEÆ. The Sundew Tribe.

Drosera, *L.* *Sundew.*
rotundifolia, *L.* Sphagnous swamps. June–August.
longifolia, *L.* Sphagnous and sandy swamps. June–August.
filiformis, *Raf.* Wet sandy places, Suffolk county, Long Island. August–September.

Parnassia, *Tourn.* *Grass of Parnassus.*
caroliniana, *Michx.* Wet meadows. July–August.

Order CISTACEÆ. The Rock-rose Tribe.

Helianthemum, *Tourn.*
canadense, *Michx.* Dry sandy places. June.

Lechea, *L.*
major, *Michx.* Dry woods and hills. July–September.
thymifolia, *Pursh.* Sandy shore of Long Island. July–September.
minor, *Lam.* Dry fields and open woods. June–September.

Hudsonia, *L.*
ericoides, *L.* Sandy woods, Suffolk county. May.
tomentosa, *Nutt.* Sandy fields near the sea, Suffolk county; and on Lake Champlain. May.

Order HYPERICACEÆ. The St. John's-wort Tribe.

Hypericum, *L.* *St. John's Wort.*
pyramidatum, *Ait.* Banks of rivers. July.
Kalmianum, *L.* Rocks, Falls of Niagara, &c. August.

HYPERICUM, (continued.)
§ perforatum, *L.* *Common St. John's Wort.* Fields, pastures, &c. July–August.
corymbosum, *Muhl.* Open woods and meadows. July–August.
ellipticum, *Hook.* Moist grounds along rivers, northern and western parts of the State.
mutilum, *L.* H. parviflorum, *Muhl.* Low grounds. July–Sept.
canadense, *L.* Wet sandy soils. June–August.
sarothra, *Michx.* Sandy places. June–August.

ELODEA, *Adans.*
virginica, *Nutt.* Swamps. July–August.

ORDER ILLECEBRACEÆ. THE KNOT-GRASS TRIBE.

ANYCHIA, *Michx.*
dichotoma, *Michx.* Dry hills and woods. June–August.

SPERGULA, *Bartl.*
§ arvensis, *L.* Fields and waste places. May–October.
rubra, *Torr. & Gr.* Arenaria rubra, *L.* Sandy fields and salt marshes April–November.

ORDER CARYOPHYLLACEÆ. THE PINK TRIBE.

MOLLUGO, *L.* *Indian Chickweed.*
verticillata, *L.* Sandy soils. June–September.

HONCKENYA, *Ehrh.*
peploides, *Ehrh.* Arenaria peploides, *L.* Seashore of Long Island.

SAGINA, *Bartl.* *Pearl-wort.*
procumbens, *L.* Wet ground. May–August.
erecta, *L.* Dry hills near New-York. May.

ARENARIA, *L.* *Sand-wort.*
squarrosa, *Michx.* Sandy fields, Suffolk county. April–Sept.
stricta, *Michx.* Rocks and barren places, northern and western part of the State. May–July.
grœnlandica, *Spreng.* Crevices of rocks on the highest summits of the Shawangunk and Adirondack mountains. July–August.

ARENARIA, (continued.)
§ serpyllifolia, *L.* Sandy field, and on rocks. April–July.
lateriflora, *L.* Damp, rather shady places. June.

STELLARIA, *L.* *Stitch-wort.*
§ media, *Smith.* Fields & cultivated grounds. March–December.
longifolia, *Muhl.* Damp shady places. June.
borealis, *Bigel.* Wet shady swamps. Western and northern parts of the State.

CERASTIUM, *L.* *Mouse-ear Chickweed.*
§ vulgatum, *L.* Cultivated grounds, road sides, &c. April–September.
§ viscosum, *L.* Fields, &c. May–September.
arvense, *L.* Rocky places. May–July.
oblongifolium, *Torr.* Rocky hills. April–June.
nutans, *Raf.* Low moist grounds. May.

SILENE, *L.* *Catch-fly.*
stellata, *L.* Dry woods. June–August.
antirrhina, *L.* Dry stony places. April–June.
§ nocturna, *L.* Old fields. July–August.
pennsylvanica, *Michx.* Dry rocks. April–June.
virginica, *L.* Yates county. *Dr. Sartwell.*

LYCHNIS, *D. C.*
§ githago, *Lam.* Agrostema githago, *L.* *Corn Cockle.* Cultivated fields. June.

SAPONARIA, *L.* *Soap-wort.*
§ officinalis, *L.* Waste grounds. July–August.
§ vaccaria, *L.* Cultivated places. July–August.

ORDER PORTULACACEÆ. THE PURSELANE TRIBE.

PORTULACA, *L.*
§ oleracea, *L.* *Purselane.* Cultivated and waste places. July–August.

CLAYTONIA, *L.* *Spring Beauty.*
virginica, *L.* Low grounds and moist woods. March–May.
caroliniana, *Michx.* Woods, usually in highlands; northern and western parts of the State. April.

ORDER ELATINACEÆ. THE WATER-PEPPER TRIBE.

ELATINE, *L.* *Water-wort.*

americana, *Arn.* Crypta minima, *Nutt.* Overflowed borders of ponds, Long Island. July–September.

ORDER LINACEÆ. THE FLAX TRIBE.

LINUM, *L.* *Flax.*

virginianum, *L.* Dry hills and woods. May–August.

§ usitatissimum. *L.* *Common Flax.* Fields, &c. June–July.

ORDER GERANIACEÆ. THE GERANIUM TRIBE.

GERANIUM, *L.*

maculatum, *L.* Open woods, &c. April–July.

carolinianum, *L.* Dry barren soils. May–June.

pusillum, *L.* Fields and road sides. Long Island, and western part of the State. May–July. West Point. *Prof. Bailey.*

robertianum, *L.* *Herb Robert.* Wet rocks. June–October.

dissectum, *L.?* Yates county. *Dr. Sartwell.*

ERODIUM, *L'Her.* *Cranesbill.*

§ cicutarium, *L'Her.* Island in Oneida lake. *Dr. Kneiskern.*

ORDER BALSAMINACEÆ. THE BALSAM TRIBE.

IMPATIENS, *L.* *Lady's Slipper.* *Balsam.*

pallida, *Nutt.* Moist shady places. July–September. Rare near the seacoast.

fulva, *Nutt.* Wet shady places. June–September.

ORDER LIMNANTHACEÆ.

FLŒRKEA, *Willd.*

proserpinacoides, *Willd.* Wet places, in the interior of the State. April–May.

ORDER OXALIDACEÆ. THE WOOD-SORREL TRIBE.

OXALIS, *L.* *Wood Sorrel.*

acetosella, *L.* Woods, west and north of Catskill mountains. June.

OXALIS, (continued.)
violacea, *L.* Rocky woods. April–May.
stricta, *L.* Cultivated grounds, fields, &c. June–September.

ORDER ZANTHOXYLACEÆ.

ZANTHOXYLUM, *L.*
americanum, *Mill.*, *Torr. & Gr.* Z. fraxineum, *Willd.* *Prickly Ash.* Rocky woods. April–May.

PTELEA, *L.*
trifoliata, *L.* *Shrubby Trefoil.* Shore of Lake Erie. June.

ORDER ANACARDIACEÆ. THE CASHEW TRIBE.

RHUS, *L.* *Sumac.*
typhina, *L.* *Stag's-horn Sumac.* Rocky hills. June.
glabra, *L.* *Smooth Sumac.* Rocky places. July–August.
copallina, *L.* *Mountain Sumac.* Rocky hills. July–August.
venenata, *D. C.* *Poison Sumac, Poison Elder.* Swamps. June.
toxicodendron, *L.* *Poison Oak, Poison Ivy.* Borders of woods, &c. June.
Var. radicans, *Torr.* R. radicans, *L.* *Poison Ivy, Mercury, &c.* Woods, and along fences. June.
aromatica, *Ait.* Dry rocky places. Catskill, &c. April–May.

ORDER MALVACEÆ. THE MALLOW TRIBE.

MALVA, *L.* *Mallows.*
§ rotundifolia, *L.* Road sides and waste grounds. May–Sept.

ALTHÆA, *L.* *Marsh Mallow.*
§ officinalis, *L.* Borders of salt marshes, Flushing, Oysterbay, &c. Long Island. August–September.

ABUTILON, *Dill.*
§ avicennæ, *Gært.* Sida abutilon, *L.* Waste places, Road sides, &c. August–September.

HIBISCUS, *L.*
virginicus, *L.* Borders of salt marshes, Long Island.
moscheutos, L. *Mallow Rose.* Borders of marshes, particularly near the salt water. August–September.

ORDER TILIACEÆ. THE LINDEN TRIBE.

TILIA, *L.* *Linden* or *Lime Tree.* *Bass-wood.*
americana, *L.* Woods. June.

ORDER VITACEÆ. THE VINE TRIBE.

VITIS, *L.* *Vine.*
labrusca, *L.* *Fox Grape.* Woods and thickets. June.
æstivalis, *Michx.* *Summer Grape.* Woods and river banks. June.
riparia, *Michx.* *Winter Grape.* Thickets along rivers.

AMPELOPSIS, *Michx.*
quinquefolia, *Michx.* *Virginian Creeper, American Joy.* Borders of woods, and along fences. July.

ORDER ACERACEÆ. THE MAPLE TRIBE.

ACER, *L.* *Maple.*
pennsylvanica, *L.* *Striped Maple, Moose-wood, Dog-wood.* Mountain woods. May.
spicatum, *Lam.* *Mountain Maple.* Rocky hills. May–June.
saccharinum, *Wang.* *Sugar Maple.* Woods. April–May.
dasycarpum, *Ehrh.* *White Maple, Soft Maple, Silver-leaved Maple.* Banks of rivers, Fishkill, &c. March–April.
rubrum, *L.* *Red* or *Swamp Maple.* Swamps and borders of streams. March–April.

ORDER CELASTRACEÆ.

STAPHYLEA, *L.* *Bladder-nut.*
trifolia, *L.* Rocky woods, particularly along rivers. May.

CELASTRUS, *L.*
scandens, *L.* *Bittersweet, Wax-work.* Borders of woods, fences, &c. June.

EUONYMUS, *L.* *Spindle Tree.*
atropurpureus, *Jacq.* *Burning Bush.* Shady woods. June–July.
americanus, *L.* *Strawberry Tree.* Wet woods and swamps. June.

ORDER RHAMNACEÆ. THE BUCKTHORN TRIBE.

RHAMNUS, *L.* *Buckthorn.*
catharticus, *L.* Rocky woods, Highlands of New-York. *Dr. Barratt.*
alnifolius, *L'Her.* Sphagnous swamps. May–June.

CEANOTHUS, *L.*
americanus, *L.* *New-Jersey Tea.* Woods and copses. June–July.
ovalis, *Bigel.* Barren rocky places, northern counties. May.

ORDER LEGUMINOSÆ. THE BEAN TRIBE.

VICIA, *L.* *Vetch.*
americana, *Muhl.* Shady moist places. June.
cracca, *L.* Borders of woods, &c. April–June.
caroliniana, *Walt.* Banks of rivers. April–May.
§ sativa, *L.* *Common Vetch, Tare.* Fields, &c. July.

ERVUM, *L.* *Tare.*
§ ? hirsutum, *L.* Borders of rivers. May–June.

LATHYRUS, *L.*
maritimus, *Bigel.* Pisum maritimum, *L.* Sandy shores and hill sides, particularly near salt water. June–July.
ochroleucus, *Hook.* Sandy hill sides. June–July.
myrtifolius, *Muhl.* Banks of rivers, &c. July–August.
palustris, *L.* Wet borders of streams. July–August.

PHASEOLUS, *L.* *Kidney Bean.*
perennis, *Walt.* Woods and borders of swamps. July–August.
diversifolius, *Pers.* Sandy shores. August–October.
helvolus, *L.* Sandy fields. August–September.

APIOS, *Boerh.*
tuberosa, *Mœnch.* Moist shady places. July.

AMPHICARPÆA, *Elliott.*
monoica, *Torr. & Gr.* Woods and thickets. August–September.

ROBINIA, *L.* *Locust Tree.*
pseudacacia, *L.* *Common Locust.* Not indigenous in this State, but almost naturalized in some places. May–June.

TEPHROSIA, *Pers.*
virginiana, *Pers.* Dry sandy soils. June–July.

TRIFOLIUM, *L.* *Clover, Trefoil.*
§ arvense, *L.* *Stone Clover, Rabbit-foot.* Dry soils. June–August.
§ pratense, *L.* *Red Clover.* Meadows, fields, &c. May–Sept.
repens, *L.* *White Clover.* Pastures, &c. April–November.
§ agrarium, *L.* *Hop Clover.* Sandy soils. June–August.

MELILOTUS, *Tourn.* *Melilot.*
§ officinalis, *Willd.* *Yellow Melilot.* River banks. June–August.
leucantha, *Koch.* *White Melilot.* River banks. June–August.

MEDICAGO, *L.* *Medick.*
§ sativa, *L.* *Lucerne.* Fields. June–July.
§ lupulina, *L.* Fields and cultivated grounds. June–August.

ASTRAGALUS, *L.* *Milk Vetch.*
canadensis, *L.* Rocky banks of rivers. June–August.

PHACA, *L.* *Bastard Vetch.*
neglecta, *Torr. & Gr.* Gravelly banks of rivers and lakes, western counties. June–July.

STYLOSANTHES, *Swartz.*
elatior, *Swartz.* Sandy woods, Suffolk county. July–August.

DESMODIUM, *D. C.*
nudiflorum, *D. C.* Dry rocky woods. July–August.
acuminatum, *D. C.* Dry woods. July.
canadense, *D. C.* Dry woods. August.
canescens, *D. C.* Moist rich soils. July–August.
Dillenii, *Darlingt.* Rich woodlands. August.
cuspidatum, *Torr. & Gr.* D. bracteatum, *D. C.* Banks of rivers, and rocky thickets. August.
marilandicum, *Boott.*, (*D. C.?*) Hedysarum marilandicum, *L.* H. obtusum, *Willd. &c.* Fields and woods. July–August.
rigidum, *D. C.* Hill sides. August–September.
ciliare, *D. C.* Borders of woods, &c. August.
paniculatum, *D. C.* Dry woods and copses. August.
rotundifolium, *D. C.* Rocky woods. August.

LESPEDEZA, *Michx.*

procumbens, *Michx.* Sandy fields and hill sides. August.
repens, *Torr. & Gr.* L. prostrata, *Pursh.* Sandy fields. Aug.
violacea, *Pers.*, *Torr. & Gr.* (L. divergens.)
  Var. 1. sessiliflora, *Torr. & Gr.* L. sessiliflora, *Michx.*
  Var. 2. angustifolia, *Torr. & Gr.* L. reticulata, *Pers.*
    Dry woods and thickets. August–September.
capitata, *Michx.* L. frutescens, *Ell.* Sandy fields, &c. August–September.
hirta, *Ell.* L. polystachya, *Michx.* Sandy fields. August–September.

LUPINUS, *L.* *Lupine.*

perennis, *L.* *Wild Lupine.* Sandy woods. June.

CROTALARIA, *L.* *Rattlebox.*

sagittalis, *L.* Dry woods and sandy fields. July–August.

BAPTISIA, *Vent.*

tinctoria, *R. Br.* *Wild Indigo.* Sandy woods and fields. July–August.

GLEDITSCHIA, *L.*

triacanthos, *L.* *Honey Locust.* Not indigenous in this State, but often planted about houses, and nearly naturalized in some places.

CASSIA, *L.*

marilandica, *L.* *Wild Senna.* Banks of streams. July–August.
nictitans, *L.* *Wild Sensitive Plant.* Sandy places. August.
chamæcrista, *L.* *Magothy-bay Bean.* Sandy places. July–August.

CERCIS, *L.* *Judas Tree.*

canadensis, *L.* Niagara county?

ORDER ROSACEÆ. THE ROSE TRIBE.

PRUNUS, *Tourn.* *Plum.*

americana, *Marshall.* P. nigra, *Ait.* *Yellow Plum.* Banks of streams, borders of fields, &c. April.
maritima, *Wang.* P. sphærocarpa, *Michx.* P. pygmæa, *Willd.* P. littoralis, *Bigel.* *Beach Plum.* Sandy fields

and hill sides near the seacoast, Long Island. May.

CERASUS, *Juss.* *Cherry.*

pumila, *Michx.* *Sand Cherry.* Rocky or sandy shores. May.

pennsylvanica, *Loisel.* C. borealis, *Michx.* Rocky woods. May.

virginiana. Prunus virginiana, *L.* P. serotina, *Torr. fl.*, *Beck, &c.;* not of *Ehrh.* *Choke-Cherry.* Rocky hills. May.

serotina, *Loisel.* Prunus serotina, *Ehrh.* Cerasus virginiana, *Michx.* *Wild Cherry*, *Black Cherry.* Woods. June.

SPIRÆA, *L.* *Meadow-sweet.*

opulifolia, *L.* *Nine-bark.* Rocky river banks. June.

salicifolia, *L.* *Queen of the Meadow.* Along brooks, and on rocky hills. June–July.

tomentosa, *L.* *Steeple-bush*, *Hardhack.* Low grounds. July.

GILLENIA, *Mœnch.*

trifoliata, *Mœnch.* *Indian Physic*, *Bowman's-root.* Woods. June.

stipulacea, *Nutt.* Western part of the State. *David Thomas, Esq.*

SANGUISORBA, *L.* *Burnet Saxifrage.*

canadensis, *L.* Wet meadows, &c. August–September.

AGRIMONIA, *L.* *Agrimony.*

eupatoria, *L.* Dry woods and fields. July.

POTENTILLA, *L.* *Cinquefoil.*

fruticosa, *L.* Bog meadows. June–September.

arguta, *Pursh.* Rocky hills. June.

argentea, *L.* Rocks and barren fields. June–September.

canadensis, *L.* P. simplex, *Michx.* *Five-finger*, *Barren Strawberry.* Fields and woods. April–August.

§? norvegica, *L.* Old fields, &c. June–August.

tridentata, *Ait.* Clefts of rocks, on mountains. June–July.

palustris, *Scop.* Comarum palustre, *L.* Swamps. June.

GEUM, *L.* *Avens.*

canadense, *Murr.* G. strictum, *Ait.* Swamps and fields. July.

virginianum, *L.* G. album, *Gmel.* Woods, &c. June–July.

rivale, *L.* *Water Avens.* Bogs and wet meadows. May–June.

COMAROPSIS, *Richard.*
fragarioides, *D. C.* Woods. May–June.

DALIBARDA, *L.*
repens, *L.* Moist shady places. June–August.

FRAGARIA, *L.* *Strawberry.*
virginiana, *Mill.* *Wild Strawberry.* Old fields, &c. May–June.
canadensis, *Michx.* Rocky hills. May–June.

RUBUS, *L.* *Bramble.*
odoratus, *L.* *Flowering Raspberry.* Rocky places. June–Aug.
strigosus, *Michx.* *Red Raspberry.* Rocks and hill sides. May.
occidentalis, *L.* *Black Raspberry, Thimble-berry.* Borders of woods, and in thickets. May.
cuneifolius, *Pursh.* Sandy fields, Long Island. May–June.
villosus, *Ait.* *Blackberry, High Blackberry.* Old fields, &c. May–June.
procumbens, *Muhl.* R. trivialis, *Pursh.* R. hispidus, *D. C.*
hispidus, *L.* R. obovalis, *Michx.* R. obovatus, *Pers.*, *Darlingt.* Shady swamps. June.
triflorus, *Richards.* R. saxatilis, var. canadensis, *Michx.* R. canadensis, *Torr. fl.* Swamps. June.

ROSA, *L.* *Rose.*
§ rubiginosa, *L.* *Sweet Brier.* Fields, &c. June.
carolina, *L.* *Swamp Rose.* Wet thickets. June–July.
parviflora, *Ehrh.* R. caroliniana, *Michx.* Old fields, &c. June.

CRATÆGUS, *Lindl.* *Hawthorn.*
crus-galli, *L.* *Cockspur Thorn, Newcastle Thorn.* Borders of woods, &c. June.
punctata, *Ait.* Woods and along streams. May–June.
pyrifolia, *Ait.* Rocky woods, &c. May–June.
coccinea, *L.* *White Thorn.* Borders of woods. May.

AMELANCHIER, *Medic.*, *D. C.*
canadensis, *Torr. & Gr.* Mespilus canadensis, *L.* *Shad-flower, June-berry, Snowy Medlar.*
Var. 1. botryapium, *Torr. & Gr.* A. botryapium, *D. C.*
Var. 2. oligocarpa, *Torr. & Gr.* Pyrus sanguinea, *Pursh.*
Var. 3. rotundifolia, *Torr. & Gr.* Aronia ovalis, *Pers.*
Var. 4. oblongifolia, *Torr. & Gr.*
Rocky woods and low grounds. April–May.

Pyrus, *Lindl.* *Apple, Pear, &c.*
§ malus, *L.* *Apple Tree.* Naturalized in some places. May.
coronaria, *L.* *Sweet-scented Crab-apple.* Woods. April–May.
aucuparia, *Gært.* Sorbus aucuparia, *L.*, *Michx.* S. americana and microcarpa, *Pursh.* *Mountain Ash.* Mountain swamps and shady hill sides. May. Not found south of the Highlands.
arbutifolia, *L. f.*
Var. 1. erythrocarpa. P. arbutifolia, *D. C.*
Var. 2. melanocarpa. P. melanocarpa, *D. C.*
Choke-berry. Woods and hill sides. May–June.

Order MELASTOMACEÆ.

Rhexia, *L.*
virginica, *L.* *Deer Grass.* Swamps. August.

Order LYTHRACEÆ. The Loose-strife Tribe.

Lythrum, *L.* *Loose-strife.*
hyssopifolia, *L.* In the State of New-York. *Nuttall.*

Cuphea, *L.*
viscosissima, *Jacq.* Fields, &c. northern and western counties. September.

Decodon, *Gmel.*
verticillatum, *Ell.* Swamps. August.

Order ONAGRACEÆ. The Evening Primrose Tribe.

Epilobium, *L.* *Willow Herb.*
angustifolium, *L.* E. spicatum, *Lam.* Banks of rivers and low grounds. July.
alpinum, *L.* Adirondack mountains. August.
coloratum, *Muhl.* Wet places. July–August.
molle, *Torr.* E. strictum, *Muhl.* Sphagnous swamps. August.
palustre, *L.* Swamps. August.
Var. albiflorum, *Lehm.* E. oliganthum, *Michx.* E. squamatum, *Nutt.* Sphagnous swamps. August–September.

Gaura, *L.*
biennis, *L.* Dry soil, river banks, &c. August.

ŒNOTHERA, *L.* *Evening Primrose.*
pumila, *L.* Œ. chrysantha and pusilla, *Michx.* Fields and meadows. June–July.
fruticosa, *L.* Œ. canadensis, *Goldie.* Dry places. June–Aug.
Var. ambigua, *Nutt.* Stony fields. August.
biennis, *L.* Œ. grandiflora, *Ait.* Œ. parviflora, *L.* Fields and meadows. June–August.

LUDWIGIA, *L.*
palustris, *Ell.* Stagnant water. July–October.
alternifolia, *L.* Swamps. July–August.

CIRCÆA, *Tourn.* *Enchanter's Nightshade.*
lutetiana. Var. 1. canadensis, *L.*
Var. 2. alpina. C. alpina, *L.*
Damp shady woods. July–August.

SUB-ORDER HALORAGEÆ.

PROSERPINACA, *L.* *Mermaid Weed.*
palustris, *L.* In water. July–August.

MYRIOPHYLLUM, *Vaill.* *Water Milfoil.*
spicatum, *L.* Deep water. July–August.
verticillatum, *L.* Ponds and streams. July–September.
heterophyllum, *Michx.* Ponds and streams. July–September.
ambiguum, *Nutt.* Ponds and muddy places, Long Island. July–August.
tenellum, *Bigel.* Borders of ponds, northern counties. August.

HIPPURIS, *L.* *Mare's-tail.*
vulgaris, *L.* Ponds and lakes, Schenectady, *Dr. Beck.* Cayuga lake, *Dr. I. Smith.* Ditches near Coldspring, Putnam county, *Prof. Bailey.*

ORDER CALLITRICHACEÆ. THE WATER-CHICKWEED TRIBE.

CALLITRICHE, *L.* *Water Chickweed.*
verna, *L.* C. heterophylla, *Pursh.* In water. May–September.
Var.? linearis. C. linearis, *Pursh.* In water. August.
Var.? terrestris. C. terrestris, *Raf.* Muddy places. July.

ORDER CUCURBITACEÆ. THE GOURD TRIBE.

SICYOS, *L.* *Single-seeded Cucumber.*
angulatus, *L.* Cultivated grounds and river banks. August.

HEXAMERIA, *Torr. & Gr.*
echinata, *Torr. & Gr.* Momordica echinata, *Willd.* Sicyos lobatus, *Michx.* Moist alluvial soils. August.

ORDER GROSSULARIACEÆ. THE CURRANT TRIBE.

RIBES, *L.* *Currant* and *Gooseberry.*
prostratum, *L'Herit.* R. rigens and trifidum, *Michx.* Rocky places; northern and western counties. May.
floridum, *L'Herit.* R. recurvatum, *Michx.* *Wild Black Currant.* Woods and hedges. May.
hirtellum, *Michx.* R. saxosum, *Hook.* Rocky places. May.
rotundifolium, *Michx.* R. triflorum, *Willd.* *Wild Gooseberry.* Rocky woods, and on mountains. May–June.
lacustre, *Poir.* Catskill mountains. May–June.
cynosbati. *L.* Mountain woods. May–June.

ORDER CACTACEÆ. THE CACTUS TRIBE.

OPUNTIA, *Tourn.* *Indian Fig.*
vulgaris, *D. C.* Cactus opuntia, *L.* *Prickly Pear.* Rocks, and in sand. June–July.

ORDER CRASSULACEÆ. THE HOUSE-LEEK TRIBE.

SEDUM, *L.* *Stone-crop.*
telephioides, *Michx.* Rocks on Seneca lake. *Prof. J. Hall.*

PENTHORUM, *L.*
sedoides, *L.* Low wet places. July–August.

ORDER SAXIFRAGACEÆ. THE SAXIFRAGE TRIBE.

SAXIFRAGA, *L.* *Saxifrage.*
virginiensis, *Michx.* Rocks. April–May.
pennsylvanica, *L.* Swamps and bogs. May–June.

CHRYSOSPLENIUM, *L.* *Golden Saxifrage.*

americanum, *Schwein.* C. oppositifolium, *Michx.* and most American botanists ; not of *Linn.* In water. April–May.

MITELLA, *L.* *False Sanicle, Bishop's Cap.*

diphylla, *L.* Rocky wet banks. May.

nuda, *L.* M. cordifolia, *Lam.* M. prostrata, *Michx.* Moist rocky places. May–June.

TIARELLA, *L.* *Mitre-wort.*

cordifolia, *L.* Rocky woods. May–June.

HEUCHERA, *L.* *Alum-root.*

americana, *L.* Shady rocks. June–July.

ORDER HAMAMELACEÆ. THE WITCH HAZEL TRIBE

HAMAMELIS, *L.* *Witch Hazel.*

virginiana, *L.* Woods. October–November.

ORDER UMBELLIFERÆ. THE UMBELLIFEROUS TRIBE.

HYDROCOTYLE, *L.* *Marsh Penny-wort.*

umbellata, *L.* Var. umbellulata, *D. C.* Sandy swamps, Long Island. July–August.

americana, *L.* Moist shady places and swamps. July.

CRANTZIA, *Nutt.*

linearis, *Nutt.* Muddy banks of rivers, West Point. *Prof. Bailey.*

SANICULA, *L.* *Sanicle.*

marilandica, *L.* Woods. June–August.

CICUTA, *L.*

maculata, *L.* *Water Hemlock.* Wet grounds. July–August.

bulbifera, *L.* Swamps. August.

ZIZIA, *Koch.*

aurea, *Koch.* Rocky hills. June.

cordata, *Koch.* Meadows, and banks of rivers. May–June.

integerrima, *D. C.* Dry hills. May.

DISCOPLEURA, *D. C.*
capillacea, *D. C.* Brackish swamps. July–September.

CRYPTOTÆNIA, *D. C.*
canadensis, *D. C.* Chærophyllum canadense, *Pers.* *Hone-wort.* Woods. June.

SIUM, *L.* *Water Parsnip.*
latifolium, *L.* S. lineare, *Michx.* Swamps. July.

SELINUM, *L.*
canadense, *Michx.* Cnidium canadense, *Spreng.* Swamps, Oriskany, Oneida county. August.

BUPLEURUM, *L.* *Modesty, Thoroughwax.*
§ rotundifolium, *L.* Cultivated grounds and waste places. Aug.

ANGELICA, *L.*
atropurpurea, *L.* *Common Angelica.* Low grounds. June.
hirsuta, *Muhl.* A. triquinata of American authors; not of *Michx.* Dry thickets, and borders of woods. August.

ARCHEMORA, *D. C.*
rigida, *D. C.* Sium rigidius, *L.* *Cowbane.* Swamps. August.

PASTINACA, *L.* *Parsnep.*
§ sativa, *L.* *Common Parsnep.* Old fields. June–August.

HERACLEUM, *L.* *Cow Parsnep.*
lanatum, *L.* Low grounds. June.

DAUCUS, *L.* *Carrot.*
§ carota, *L.* Fields and road sides. July–September.

OSMORHIZA, *Raf.*
longistylis, *D. C.* *Sweet Cicely.* Woods, in rich soil. May.
brevistylis, *D. C.* Shady rocky woods. May.

CONIUM, *L.* *Hemlock.*
§ maculatum, *L.* *Poison Hemlock.* Waste places. June–July.

ORDER ARALIACEÆ. THE ARALIA TRIBE.

ARALIA, *L.*
nudicaulis, *L.* *Wild Sarsaparilla.* Rocky woods. May–June.

ARALIA, (continued.)
racemosa, *L.* *Spikenard.* Woods. July.
hispida, *L.* *Wild Elder.* Rocks. July.

PANAX, *L.* *Ginseng.*
quinquefolium, *L.* *Common Ginseng.* Woods. July.
trifolium, *L.* *Dwarf Ginseng, Ground-nut.* Moist shady woods. April.

ORDER CORNACEÆ. THE DOG-WOOD TRIBE.

CORNUS, *L.* *Dog-wood.*
canadensis, *L.* *Dwarf Dog-wood.* Woods and swamps. May–June.
florida, *L.* *Common Dog-wood.* Woods. May.
circinata, *L'Herit.* Margins of streams. June.
sericea, *L'Herit.* *Swamp Dog-wood.* Low grounds. June.
stolonifera, *Michx.* C. alba, of American botanists; not of *Linn.* Wet banks of streams, and swamps. June.
paniculata, *L'Herit.* Banks of streams. June.
alternifolia, *L.* Shady woods. May–June.

ORDER CAPRIFOLIACEÆ. THE HONEYSUCKLE TRIBE.

SAMBUCUS, *L.* *Elder.*
canadensis, *L.* *Common Elder.* Low grounds, &c. June–July.
pubens, *Michx.* *Red-berried Elder.* Rocky woods. May.

VIBURNUM, *L.*
prunifolium, *L.* *Black Haw, Sloe.* Woods. May–June.
lentago, *L.* Woods, along streams. May.
cassinioides, *L.;* not of authors. Swamps, northern counties.
nudum, *L.* Swamps. June.
dentatum, *L.* Moist rocky places. June.
pubescens, *Pursh.* Rocks. June.
lantanoides, *Michx.* *Hobble-bush.* Mountain woods. May–June.
acerifolium, *L.* *Arrow-wood, Dogmackie.* Woods. June.
oxycoccus, *Pursh.* *Bush Cranberry.* Rocky woods. June.

TRIOSTEUM, *L.*
perfoliatum, *L.* *Fever-root, Horse Gentian, Wild Coffee.* Rocky woods. May–June.

DIERVILLA, *Tourn.*
Tournefortii, *Michx.* Rocky woods. June–July.

LONICERA, *L.* *Honeysuckle.*
flava, *Sims.* Catskill mountains. June–July. *Pursh.*
hirsuta, *Eaton.* Caprifolium pubescens, *Goldie.* Rocky woods. June.
parviflora, *Lam.* Rocky woods. June.
grata, *Ait.* Mountains, New-York. *Pursh.* I have not found this species.
ciliata, *Muhl.* Rocky hills. May–June.
cærulea, *L.* L. villosa, *Muhl.* Xylosteum villosum, *Michx.* X. solonis, *Eat.* Rocky hills, Poughkeepsie. May.
oblongifolia, *Hook.* Xylosteum oblongifolium, *Goldie.* Rocks. June.
sempervirens, *Ait.* Rocks near water, Island of New-York. May.

SYMPHORICARPOS, *Dill.*
vulgaris, *Michx.* Symphoria glomerata, *Pers.* Yates county. *Dr. Sartwell.*
racemosus, *Michx.* Rocky river banks. July.

LINNÆA, *Gronov.*
borealis, *L.* *Twin-flower.* Shady moist woods and swamps.

ORDER RUBIACEÆ. THE MADDER TRIBE.

HEDYOTIS, *L.*, *Hook.*
glomerata, *Ell.* Damp shady soils, near New-York. August.
cærulea, *Hook.* Houstonia cærulea, *L.* Wet banks and woods. April–September.
longifolia, *Hook.* Houstonia longifolia, *Michx.* Woods, &c. June.
ciliolata, *Hook.* Houstonia ciliolata, *Torr.* Wet rocks and banks, near the Great Lakes. June–July.

MITCHELLA, *L.* *Partridge-berry.*
repens, *L.* Woods. June.

CEPHALANTHUS, *L.* *Button-bush.*
occidentalis, *L.* Swamps and along streams. July–August.

GALIUM, *L.* *Bedstraw*, *Goose-grass.*
trifidum, *L.* Low wet places. July.

GALIUM, (continued.)

tinctorium, *L.* Moist shady woods. June–July.
asprellum, *Michx.* Wet thickets. July.
aparine, *L.* Shady rocky places, and along fences. May.
triflorum, *Michx.* Moist woods. July.
pilosum, *Ait.* Dry woods and thickets. June.
circæzans, *Michx.* Woods, in rich soil. June–July.
lanceolatum, *Torr.* Moist woods. July.
boreale, *L.* Dry woods. July–August.

ORDER VALERIANACEÆ. THE VALERIAN TRIBE.

FEDIA, *Mœnch.* *Lamb Lettuce.*

radiata, *Michx.* Meadows and banks of rivers. May.

VALERIANA, *L.* *Valerian.*

sylvatica, *Richardson.* Sphagnous swamps in Wayne county *Dr. Sartwell.*

ORDER DIPSACEÆ. THE SCABIOUS TRIBE.

DIPSACUS, *L.* *Teasel.*

§ sylvestris, *L.* *Wild Teasel.* Waste places. July.

ORDER COMPOSITÆ.

VERNONIA, *Schreb.* *Iron-weed.*

noveboracensis, *Willd.* Low grounds. August.

LIATRIS, *Schreb.* *Blazing Star.*

scariosa, *Willd.* Sandy fields. September.
flexuosa, *Thomas, in Sill. Jour. Oct.* 1839.

EUPATORIUM, *L.*

sessilifolium, *L.* Rocky woods. August.
perfoliatum, *L.* *Boneset, Thoroughwort.* Wet grounds. August.
purpureum, *L.* E. verticillatum, *Willd.* Low grounds. August.
maculatum, *L.* E. trifoliatum, *L.* E. ternifolium, *Ell.*, *D. C.* Swamps, and borders of wet woods. August. Perhaps not distinct from the preceding.
ageratoides, *L. f.* Woods and rocky banks. August–September.
teucrifolium, *Willd.* Low grounds. August.

MIKANIA, *Willd.*
scandens, *Willd.* Wet thickets. August.

NARDOSMIA, *Cass.*
palmata, *Hook.* Tussilago palmata, *Ait.* Swamps near Saratoga. *Dr. Steele.*

TUSSILAGO, *Tourn.* *Coltsfoot.*
farfara, *L.* Moist banks. April. Introduced?

ASTER, *L.* *Starwort.*
novæ-angliæ, *Ait.* Low grounds. September.
patens, *Ait.* A. amplexicaulis, *Michx.* Dry woods. August–September.
phlogifolius, *Muhl.* Dry woods. August.
cordifolius, *L.* Woods. September.
paniculatus, *Ait.* Dry woods. August–September.
heterophyllus, *Willd.* Rocky banks and thickets. September.
diversifolius, *Michx.* Dry woods. September.
prenanthoides, *Muhl.* Low grounds. September.
puniceus, *L.* Swamps. September.
novæ-belgii, *L.* Near Albany. *Dr. Beck.*
parviflorus, *Nees.* Old fields. September.
divergens, *Ait.* Fields and thickets. September.
fragilis, *Willd.* Swamps. September.
tradescanti, *L.* Thickets. August–October.
ericoides, *L.* Wet bushy places. September.
diffusus, *Ait.* Old fields. September.
miser, *L.* Old fields. September–October.
multiflorus, *Ait.* Fields and dry banks. September.
concinnus, *Willd.* Swamps. September.
mutabilis, *Ait.* Rocky river banks. September.
lævis, *L.* Moist shady banks. September.
rubricaulis, *Lam.* A. cyaneus, *Hoffm.* Borders of woods. Sept.
bellidiflorus, *Willd.* Meadows. September.

A few other species of this genus have been collected, but not determined.

TRIPOLIUM, *Nees.*
flexuosum, *Nees.* Aster flexuosus, *Nutt.* Salt marshes. Sept.
subulatum, *Nees.* A. subulatus, *Michx.?* Salt marshes.

SERICOCARPUS, *Nees.*

solidaginoides, *Nees.* Aster solidaginoides, *Willd.* Dry woods. July–August.

conyzoides, *Nees.* Aster conyzoides, *Willd.* Dry woods and thickets. July–August.

HELEASTRUM, *D. C.*

album, *D. C.* Chrysopsis alba, *Nutt.* Rocky banks of Black river, Jefferson county. August. *Dr. Crawe.*

BIOTIA, *D. C.*

macrophylla, *D. C.* Aster macrophyllus, *L.* Rocky woods. August–September. B. Schreberi, latifolia and glomerata, *D. C.* do not appear to be more than varieties of this species.

corymbosa, *D. C.* Dry woods. July–August.

DIPLOSTEPHIUM, *Cass.*

amygdalinum, *Cass.* Aster amygdalinus, *L.* Also? A. umbellatus, *Ait.* Low grounds. August–September.

cornifolium, *D. C.* A. cornifolius, *Muhl.* Woods. August.

acuminatum, *D. C.* A. acuminatus, *Michx.* Mountain woods. September.

DIPLOPAPPUS, *Cass., D. C.*

linariæfolius, *Lindl.* Aster linariifolius, *L.* Rocks and sandy woods.

ERIGERON, *L.* *Fleabane.*

philadelphicum, *L.* Woods. June–August.

pulchellum, *Michx.* E. bellidifolium, *Muhl.* *Poor Robert's Plantain.* Woods. May–June.

purpureum, *Ait.* Sides of hills, &c. June.

canadense, *L.* E. pusillum, *Nutt.* *Horse-weed, Butter-weed.* Fields, &c. August–September.

STENACTIS, *Nees.*

annua, *Nees.* Aster annuus, *L.* Erigeron heterophyllum, *Nutt.* Fields and meadows. June–July.

strigosa, *D. C.* Erigeron strigosum, *Muhl.* Fields and woods. June–August.

Chrysopsis, *Nutt.*

mariana, *Nutt.* Dry sandy woods. September.
falcata, *Ell.* Sandy fields, Suffolk county. September.

Solidago, *L.* *Golden-rod.*

canadensis, *L.* Woods. August–September.
gigantea, *Ait.* Low grounds. August.
ciliaris, *Muhl.* Dry fields and woods. August.
rugosa, *Mill.* Woods and low grounds. August–September.
altissima, *L.* Low grounds. August–September.
nemoralis, *Ait.* S. puberula, *Nutt.?* Dry woods and fields. Aug.
patula, *Muhl.* Low grounds. September.
ulmifolia, *Muhl.* Low grounds. August–September.
arguta, *Ait.* Rocky banks. August.
odora, *Ait.* Mountain woods and thickets. August–September.
bicolor, *L.* Woods and thickets. August–September.
flexicaulis, *L.* Rocky woods. September.
Var. latifolia. S. latifolia, *L.* Rocky banks. September.
serotina, *L.* Rocky banks. September.
juncea, *Ait.* Swamps. September.
cæsia, *L.* Thickets. September.
squarrosa, *Muhl.*, *Nutt.* Rocky hills. August–September.
sempervirens, *L.* Borders of salt and brackish meadows. September–October.
virgaurea, *L.* var. alpina. Summit of Mount Marcy, Essex county. August.
rigida, *L.* Highlands of New-York. *Dr. Barratt.*
graminifolia, *Ell.* S. lanceolata, *Willd.* Low grounds. August.
tenuifolia, *Pursh.* Sandy soils. August–September.

Baccharis, *L.* *Ploughman's Spikenard.*

halimifolia, *L.* Seacoast of Long Island. September–October.

Pluchea, *Cass.*

fœtida, *Torr. & Gr.;* not of *D. C.* P. marilandica and camphorata, *D. C.* Baccharis fœtida, *L.* Conyza marilandica, *Michx.*, *Ell.* Borders of salt marshes. August.

Inula, *L.*

§ helenium, *L.* *Elecampane.* Fields and road sides. July.

Silphium, *L.*
ternatum, *Retz.* Near Niagara. *Dr. Eddy.*

Polymnia, *L.*
uvedalia, *L.* Rocky woods. July–August.
canadensis, *L.* Shady hill sides. June–July.

Xanthium, *L.* *Clot-weed, Cockle-bur.*
§ strumarium, *L.* Borders of fields, &c. August–September.
echinatum, *Murr.* X. macrocarpum, var. glabratum, *D. C.* X. orientale, *Linn. f.*, *Muhl.* X. maculatum, *Raf.* Sandy shores, near salt water. August.
§ spinosum, *L.* Road sides and waste places. September.

Ambrosia, *L.* *Hog-weed.*
elatior, *L.* *Rag-weed, Bitter-weed.* Old fields. August–Sept.
trifida, *L.* Along fences, and in low grounds. August.

Iva, *L.* *False Jesuit's Bark.*
frutescens, *L.* *High-water Shrub.* Salt marshes. August.

Heliopsis, *Pers.*
lævis, *Pers.* Banks of streams. August.

Rudbeckia, *L.*
laciniata, *L.* Moist thickets. July–August.

Obeliscaria, *Cass.*
pinnata, *Cass.* Rudbeckia pinnata, *Vent.* Shore of Lake Erie. *Dr. Sartwell.*

Coreopsis, *L.* *Tickseed Sunflower.*
trichosperma, *Michx.* Cedar swamps, Long Island. August.

Actinomeris, *Nutt.*
alternifolia, *D. C.* A. squarrosa, *Nutt.* Coreopsis alternifolia, *L.* Borders of Crooked lake, Yates county. *Dr. Sartwell.*

Helianthus, *L.* *Sunflower.*
divaricatus, *L.* Woods and hill sides. July–August.
frondosus, *L.* Woods. July and August.
decapetalus, *L.* Woods and thickets. August.
trachelifolius, *Willd.* Low grounds. August–September.
altissimus, *L.* Swamps. August.

BIDENS, *L.* *Bur Marigold.*
connata, *L.* Swamps and low grounds. September.
frondosa, *L.* Along fences, &c. August–September.
cernua, *Willd.* B. petiolata, *Nutt.?* Swamps. August–Sept.
chrysanthemoides, *Michx.* Low grounds. August–September.
Beckii, *Torr.* Lakes and ponds near Schenectady, *Dr. Beck.* Western part of New-York, *Dr. Aikin* and *Dr. Gray.*
bipinnata, *L.* *Spanish Needles.* Fields and rocky hills. August–September.

HELENIUM, *L.*
autumnale, *L.* Swamps. August–September.

MARUTA, *Cass.*
§ cotula, *Cass.* Anthemis cotula, *L.* *May-weed, Stinking Chamomile.* Road sides, &c. June–September.

ACHILLEA, *L.* *Yarrow, Milfoil.*
§ millefolium, *L.* Fields, pastures, &c. June–August.

LEUCANTHEMUM, *Tourn.*
§ vulgare, *Lam.* Chrysanthemum leucanthemum, *L.* *Ox-eye Daisy.* Pastures, &c. June–August.

ARTEMISIA, *L.* *Wormwood.*
§ vulgaris, *L.* *Mugwort.* Fields and road sides. September.
canadensis, *L.* *Wild Wormwood.* Sandy shores of Lake Erie. July–August. *Dr. Beck.*
caudata, *Michx.* Sandy seacoast of Long Island. September.

TANACETUM, *L.* *Tansey.*
§ vulgare, *L.* *Common Tansey.* Road sides, &c. July–Aug.

GNAPHALIUM, *L.*, *D. Don.* *Cudweed.*
decurrens, *Ives.* Fields and borders of woods. August.
polycephalum, *Michx.* *Life Everlasting, Balsam.* Old fields, &c. August–September.
uliginosum, *L.* Low grounds. July–August.
purpureum, *L.* Dry open woods. July. G. sylvaticum, *Pursh.* (not of *Linn.*), G. americanum, *Pursh.* (not of *Mill.*), and G. pennsylvanicum, *Willd.* seem not to be distinct from this species.

FILAGO, *Tourn.*
§? germanica, *L.* Gnaphalium germanicum, *Willd.* Old fields, Staten Island, &c. August–September.

ANTENNARIA, *R. Br.*
plantaginea, *R. Br.* Gnaphalium plantagineum, *L.* Dry woods and hills. April–May.
margaritacea, *R. Br.* Gnaphalium margaritaceum, *L.* Dry woods and hills. August.

ERECHTITES, *Raf.*
hieracifolia, *Raf.* Senecio hieracifolius, *Raf.* *Fire-weed.* Low grounds. August.

ARNICA, *L.*
montana, *L.* Sources of the Hudson, Essex county. August.

CACALIA, *L.*
suaveolens, *L.* In the State of New-York. *B. D. Greene, Esq.*
atriplicifolia, *L.* Near Geneseo.

SENECIO, *L.* *Groundsel.*
vulgaris, *L.* Road sides, &c. Long Island. August.
balsamitæ, *Willd.* Rocky banks of streams. June.
aureus, *L.* S. obovatus, *Muhl.* S. gracilis, *Ph.* Meadows, and along streams; sometimes on rocks. May–June.

CENTAUREA, *L.* *Knapweed.*
§ cyanus, *L.* *Bluebottle.* Cultivated grounds. July.

CNICUS, *Vaill.*
§ benedictus, *L.* *Blessed Thistle.* Road sides, &c. June.

CIRSIUM, *Tourn.* *Thistle.*
lanceolatum, *Scop.* Carduus lanceolatus, *L.* *Common Thistle.* Fields, road sides, &c. June–September.
altissimum, *Spreng.* Carduus altissimus, *L.* Old fields. August.
discolor, *Spreng.* Cnicus discolor, *Muhl.* Fields and thickets. August.
pumilum, *Spreng.* Carduus pumilus, *Nutt.* Cnicus odoratus, *Muhl.* Old fields. July.
muticum, *Michx.* Swamps. September.
§ arvense, *Scop.* Cnicus arvensis, *Hoff.* *Canada Thistle.* Fields and road sides. July–September.

LAPPA, *Tourn.*

§ major, *Gært.* Arctium lappa, var. *L.* A. lappa, *Willd.* *Common Burdock.* Old fields, &c. July–Sept.

CICHORIUM, *L.*

§ intybus, *L.* *Chicory, Wild Succory.* Fields, &c. August.

CYNTHIA, *D. Don.*

virginica, *Don.* Troximon virginicum, *Pursh.* Dry sandy soils. May–July.

KRIGIA, *Schreb.*

virginica, *Willd.* Woods and fields. May–June.

LACTUCA, *Tourn.* *Lettuce.*

elongata, *Muhl.* L. canadensis, *L.?* Thickets and borders of woods. July.

integrifolia, *Bigel.* Hill sides, &c. July.

TARAXACUM, *Hall.*

§ dens-leonis, *Desf.* Leontodon taraxacum, *L.* *Dandelion.* Pastures, road sides, &c. March–November.

SONCHUS, *L.*, *Cass.* *Sow Thistle.*

§ oleraceus, *L.* Old fields and cultivated grounds. August–Sept.

§ palustris, *L.* New-York. *Muhlenberg.*

HIERACIUM, *L.* *Hawk-weed.*

venosum, *L.* H. Gronovii, *L.* in part. Dry open woods, &c. May–June.

Gronovii, *L.* in part.; *Michx.* β. Woods and meadows. August–September.

Var. marianum. H. marianum, *Willd.* Woods. August.

canadensis, *Michx.* H. virgatum and? fasciculatum, *Pursh.* H. Kalmii, *Torr. comp.*, *Beck*, *&c.;* not of *Linn.* Highlands of New-York, and in the western parts of the State.

paniculatum, *L.* Dry woods. August.

NABALUS, *Cass.*

altissimus, *Hook.* N. alatus, *Hook.* Prenanthes altissima, L.

albus, *Hook.* Prenanthes alba, *L.* Dry woods, &c. August–September.

NABALUS, (continued.)

Var. 1. serpentaria. Prenanthes serpentaria, *Pursh.* Nabalus serpentarius, *Hook.* Fields and copses. August.

Var. 2. nanus. Prenanthes alba, var. nana, *Bigel.* Nabalus nanus and? N. Bootii, *D. C.* High mountains of Essex county. August.

MULGEDIUM, *Cass.*

floridanum, *D. C.* Sonchus floridanus, *L.* Rocky hills. August.

acuminatum, *D. C.* S. acuminatus, *Willd.* Woods. August.

ORDER LOBELIACEÆ.

LOBELIA, *L.*

Dortmanna, *L.* *Water Gladiole.* Shallow water. Long Island, *Dr. Barratt.* West Point, *Prof. Bailey.* Northern part of the State, *Dr. Emmons.* August–September.

Kalmii, *L.* Wet rocks, &c. July–August.

Claytoniana, *Michx.* Woods and meadows. June.

siphilitica, *L.* Wet meadows and swamps. September.

Var. alba. Near Peekskill.

cardinalis, *L.* *Cardinal Flower.* Wet places. August–Sept.

inflata, *L.* *Indian Tobacco.* Fields, road sides, &c. August.

ORDER CAMPANULACEÆ. THE BELL-FLOWER TRIBE.

CAMPANULA, *L.* *Bell Flower.*

rotundifolia, *L.* Rocky banks, and on mountains. June–August.

amplexicaulis, *Michx.* C. perfoliata, *L.* Fields, &c. June–July.

americana, *L.* C. acuminata, *Michx.* Moist shady places, western counties. July.

aparinoides, *Pursh.* C. erinoides, *Muhl.;* not of *Linn.* Swamps and wet thickets. June–July.

ORDER ERICACEÆ. THE HEATH TRIBE.

ANDROMEDA, *L.*

mariana, *L.* Sandy woods and fields. June–July.

polifolia, *L.* Sphagnous swamps. June.

racemosa, *L.* Wet thickets. June.

ANDROMEDA, (continued.)
paniculata, *L.* (in part.), *Willd. &c.* A. ligustrina, *Muhl.* Vaccinium ligustrinum, *L.* *Pepper-bush.* Moist woods and thickets. June.
calyculata, *L.* Swamps. April.

ARBUTUS, *L.* *Bear-berry.*
uva-ursi, *L.* Dry sandy soils. April–May.

GAUTIERA, (incorrectly written *Gaultheria* by most botanists.)
procumbens, *L.* *Partridge-berry.* Sandy woods. May–June.

CLETHRA, *L.* *Sweet-scented Pepper-bush.*
alnifolia, *L.* Swamps and wet thickets. August.

RHODODENDRON, *L.* *Rose-bay.*
maximum, *L.* *Great Laurel.* Swamps. June–July.
canadense. Rhodora canadensis, *L.* Mountain bogs. May.
nudiflorum, *Torr.* Azalea nudiflora, *L.* *Wild Honeysuckle.* Woods and thickets. April–May.
viscosum, *Torr.* Azalea viscosa, *L.* Woods and swamps. June.
hispidum, *Torr.* Azalea hispida, *Pursh.* Borders of mountain lakes, New-York. *Pursh.* I have not found this species.

KALMIA, *L.* *Laurel.*
latifolia, *L.* *Calico-bush, High Laurel.* Rocky hills. May–June.
angustifolia, *L.* *Dwarf Laurel, Sheep Laurel.* Low wet places. June.
glauca, *L.* Sphagnous swamps. April–May.
Var. rosmarinifolia, *Pursh.* Swamps near Albany, &c.

EPIGÆA, *L.* *Mountain Tea.*
repens, *L.* *Ground Laurel, Trailing Arbutus.* Sandy woods and hills. April.

LEDUM, *L.*
latifolium, *L.* *Labrador Tea.* Swamps. May–June.

SUB-ORDER VACCINEÆ.

VACCINIUM, *L.* *Whortleberry* or *Huckleberry.*
stamineum, *L.* *Deer-berry.* Dry woods. May–June.

dumosum, *Andr.* Sandy woods. June.
frondosum, *L.* *Blue Tangles.* Woods. June.
resinosum, *Ait.* Dry woods and rocky hills. May.
corymbosum, *L.* *Swamp* or *High Huckleberry.* Shady swamps. May.
pennsylvanicum, *Lam.* *Blue Huckleberry.* Rocky woods. May.
tenellum, *Ait.* *Dwarf Blue Huckleberry.* Dry woods. May.
uliginosum, *L.* Sources of the Hudson in the Adirondack mountains. July–August.

OXYCOCCUS, *Pers.* *Cranberry.*
macrocarpus, *Pursh.* *Common Cranberry.* Swamps. June.
vulgaris, *Pers.* Sphagnous swamps, northern and western counties. June.

LASIERPA, *Torr.*
hispidula, *Torr.* Vaccinium hispidulum, *L.* Gaultheria serpyllifolia, *Pursh.* Swamps. April–May. The fruit of this genus is incorrectly described in my Flora of the Northern States.

SUB-ORDER PYROLEÆ.

PYROLA, *L.* *Winter-green.*
rotundifolia, *L.* Woods.
chlorantha, *Swartz.* P. asarifolia, *Torr.*, *Beck;* not of *Michx.* Woods, northern and western counties. June–July.
elliptica, *Nutt.* *Shin-leaf.* Dry woods. July.
minor, *L.* Western part of New-York. *Pursh.* I have not found this species, and doubt whether it is a native of the State.
secunda, *L.* Dry woods. June–July.
uniflora, *L.* Woods, northern and western counties. June.
uliginosa, *Torr. & Gr.* Sphagnous swamps, Oneida county, and northern part of the State. *Dr. Gray* and *Dr. Kneiskern.*

CHIMAPHILA, *Pursh.*
umbellata, *Nutt.* *Pipsissawa.* Dry woods. June.
maculata, *Pursh.* Dry woods. June.

SUB-ORDER MONOTROPEÆ.

MONOTROPA, *L.* *Bird's-nest.*
uniflora, *L.* *Indian Pipe.* Woods. June–July.

HYPOPITHYS, *Dill.* *Pine-sap.*
lanuginosa, *Nutt.* Moist woods. July–August.

PTEROSPORA, *Nutt.*
andromedea, *Nutt.* Clayey soils. Near Albany, *Dr. James, Eaton.* Seneca lake, *Dr. Gray.* Near Niagara Falls, *Whitlow.* Little Falls of the Mohawk, *Cooper.* Port Henry, Lake Champlain, *Prof. A. Hopkins.* Near Sacket's-Harbor, *Dr. Wood.* July.

ORDER EBENACEÆ. THE EBONY TRIBE.

DIOSPYROS, *L.* *Persimmon.*
virginiana, *L.* Woods. May.

ORDER AQUIFOLIACEÆ. THE HOLLY TRIBE.

ILEX, *L.* *Holly.*
opaca, *Ait.* Sandy woods, Long Island. June.

NEMOPANTHES, *Raf.*
canadensis, *Raf.* Ilex canadensis, *Michx.* Mountains. May.

PRINOS, *L.* *Winter-berry.*
verticillatus, *L.* Swamps. June–July.
lævigatus, *Pursh.* Cedar swamps. June.
glaber, *L.* *Ink-berry.* Swamps. July.

ORDER OLEACEÆ. THE OLIVE TRIBE.

LIGUSTRUM, *L.* *Privet* or *Prim.*
§ vulgare, *L.* Woods and along fences. May–June.

FRAXINUS, *L.* *Ash.*
sambucifolia, *Willd.* *Black Ash.* Wet woods and swamps. April.
acuminata, *Lam.* F. americana, *Michx. f.* Woods. May.

ORDER APOCYNACEÆ. THE DOG-BANE TRIBE.

APOCYNUM, *L.* *Dog's-bane.*

androsæmifolium, *L.* Borders of woods, and along fences. June.

cannabinum, *L.* A. hypericifolium, *Ait.* A. pubescens, *R. Br.* Banks of streams, and on hill sides. July.

ORDER ASCLEPIADACEÆ. THE MILKWEED TRIBE.

ASCLEPIAS, *L.* *Milkweed, Swallow-wort.*

syriaca, *L.* *Common Milkweed.* Fields, &c. June–July.

phytolaccoides, *L.* Rocky woods. June–July.

variegata, *L.* A. hybrida, *Michx.* Dry woods. June–July.

purpurascens, *L.* Borders of woods and thickets. July.

incarnata, *L.* Low grounds. July–August.

obtusifolia, *Michx.* Sandy woods and hill sides. June–July.

quadrifolia, *Jacq.* Rocky woods. June.

verticillata, *L.* Dry hills. July.

tuberosa, *L.* *Pleurisy-root, Butterfly-weed.* Sandy fields. July–August.

ACERATES, *Ell.*

viridiflora, *Ell.* Asclepias viridiflora, *Raf.* Sandy fields. July.

PERIPLOCA, *L.*

græca, *L.* Western part of the State, indigenous or naturalized, *Nuttall.* Near Rochester, *Dr. Bradley.* I have never found this plant, nor have I received it from any part of the United States.

ORDER GENTIANACEÆ. THE GENTIAN TRIBE.

GENTIANA, *L.* *Gentian.*

saponaria, *L.* *Soap Gentian.* Borders of swamps. September.

Var.? linearis, *Griseb.* G. pneumonanthe, *Michx., Bigel.;* not of *Linn.* Wet grassy places. Sources of the Hudson, Essex county, August 7th. This is probably a distinct species.

quinqueflora, *Lam.* Woods. August.

crinita, *Frœl.* Rocky open woods. September.

HALENIA, *Borkh.*

deflexa, *Griesb.* Swertia deflexa, *Smith.* Northern part of the State. *Prof. Hadley.*

FRASERA, *Walt.*

carolinensis, *Walt.* *American Columbo.* Swamps. Western part of the State. *Prof. Hadley.*

SABBATIA, *Adans.*

stellaris, *Pursh.* Salt marshes. August.

angularis, *Pursh.* *Centaury.* Meadows and old fields. July–August.

chloroides, *Pursh.* Salt marshes. August.

ERYTHRÆA, *Rich.*

Muhlenbergii, *Griseb.* E. centaurium, *Beck*, not of *Pers.* Open woods and fields, Rockland county. July. Near Oswego, *Dr. Aikin.*

ramosissima, *Pers.?* Borders of salt marshes, Long Island. July.

CENTAURELLA, *Michx.*

autumnalis, *Pursh.* Dry meadows, &c. August.

LIMNANTHEMUM, *Gmel.*

lacunosum, *Griseb.* Villarsia cordata, *Ell.* In water. August.

MENYANTHES, *L.*

trifoliata, *L.* *Buckbean.* Marshes. May.

ORDER BIGNONIACEÆ. THE TRUMPET-FLOWER TRIBE.

CATALPA, *Juss.* *Bean Tree.*

cordifolia, *Duham.* Planted about habitations: not indigenous in any part of the State. July.

ORDER PEDALIACEÆ. THE OIL-SEED TRIBE.

MARTYNIA, *L.*

§ proboscidea, *L.* *Unicorn Plant.* Cultivated grounds, &c. August.

Order POLEMONIACEÆ. The Greek-Valerian Tribe.

Phlox, *L.*
divaricata, *L.* Dry woods and rocky banks. May.
subulata, *L.* *Mountain Pink.* Rocky hills. May.

Polemonium, *L.* *Greek Valerian, Jacob's Ladder.*
reptans, *L.* Cattaraugus county. *Dr. Bradley.*

Order CONVOLVULACEÆ. The Bindweed Tribe.

Convolvulus, *L.* *Bind-weed.*
§ arvensis, *L.* Near Fort Ticonderoga, Lake Champlain, *Mr.* ———. Near Albany, *Dr. Beck.*
sepium, *L.* Moist thickets. June–July.
spithamæus, *L.* Dry woods and fields. June.
panduratus, *L.* *Wild Potato-vine, Mechoacanna, Man-of-the-earth.* Borders of woods and hill sides. July–August.

Cuscuta, *L.* *Dodder.*
americana, *L.* Low grounds. August.
§ epilinum, *Weihe.* C. europæa, *Beck, Darlington, &c.;* not of *Linn.* *Flax Dodder.* Parasitic on flax. June.

Order BORAGINACEÆ. The Borage Tribe.

Lithospermum, *L.* *Gromwell.*
§ arvense, *L.* *Corn Gromwell.* Cultivated grounds, pastures, &c. May.
latifolium, *Michx.* Sandy fields and river banks. May. L. denticulatum, *Lehm.* is said to grow in the State of New-York, but I have never received specimens of the plant from any part of the United States.

Batschia, *Gmel.*
canescens, *Michx.* *Puccoon.* Northern part of the State, *Prof. Hadley.* June.

Onosmodium, *Michx.*
hispidum, *Michx.* Dry hills. July.

Symphytum, *L.* *Comfrey.*
§ officinale, *L.* Cultivated grounds. June.

Lycopsis, *L.* *Small Bugloss.*
§ arvensis, *L.* Sandy fields. June–July.

Myosotis, *L.* *Scorpion Grass.*
palustris, *Roth.* Ditches and wet grounds. May–July.
arvensis, *Sibth.* Sandy woods. May–June.

Echinospermum, *Lehm.*
§ lappula, *Lehm.* Road sides and fields. July.
virginicum, *Lehm.* Borders of woods and thickets. July.

Cynoglossum, *L.* *Hound's-tongue.*
officinale, *L.* Road sides, &c. May–June.
virginicum. *L.* Woods, in rich soil. May–June.

Pulmonaria, *L.* *Lungwort.*
virginica, *L.* Sandy alluvial soil, western counties. May.

Echium, *L.* *Viper's Bugloss.*
§ vulgare, *L.* *Blue Thistle.* Fields and hill sides. June.

ORDER HYDROPHYLLACEÆ.

Hydrophyllum, *L.*
virginicum, *L.* Moist shady places. June.
canadense, *L.* Woods. June.

ORDER LABIATÆ. THE MINT TRIBE.

Lycopus, *L.* *Water Horehound.*
sinuatus, *Ell.*, *Benth.* L. europæus, *Pursh* and others, not of *Linn.* L. americanus, *Muhl.* Overflowed places. August.
virginicus, *L.* *Bugle-weed.* Low wet places and woods. July–August.

Mentha, *L.* *Mint.*
§ viridis, *L.* *Spearmint.* Moist grounds. July–August.
§ piperita, *L.* *Peppermint.* Moist grounds. August.
canadensis, *L.* M. borealis, *Michx.* Wet thickets and meadows. August.

ISANTHUS, *Michx.*
cæruleus, *Michx.* Sandy banks of rivers. July–August.

MONARDA, *L.* *Horse-mint.*
fistulosa, *L.*, *Benth.* M. allophylla, *Michx.* M. clinopodia, *L.* M. oblongata and rugosa, *Ait.* Rocky banks and thickets. July.
didyma, *L.* M. Kalmiana, *Pursh.* *Oswego Tea.* Wet thickets. August.
punctata, *L.* Dry sandy fields. September.

BLEPHILIA, *Raf.*
hirsuta, *Raf.*, *Benth.* Monarda hirsuta, *Pursh.* Wet woods. August.

PYCNANTHEMUM, *Michx.*
incanum, *Michx.* Rocky woods. July–August.
Torrei, *Benth.* Rocky hill sides, Rockland county. August.
lanceolatum, *Pursh*, *Benth.* Blephilia verticillatum, *Michx.* B. lanceolatum, *Willd.* Thickets and rocky hills. July–August.
linifolium, *Pursh.* Moist thickets and exsiccated swamps. July.

ORIGANUM, *L.* *Marjoram.*
§ vulgare, *L.* *Wild Marjoram.* Rocky banks. July–August.

COLLINSONIA, *L.* *Horse Balm.*
canadensis, *L.* *Knot-root.* Rocky shady soils. July–August.

CUNILA, *L.*
mariana, *L.* *Dittany.* Rocky hills. August–September.

HEDEOMA, *Pers.*
pulegioides, *Pers.* *Pennyroyal.* Dry sterile soils. August.

MICROMERIA, *Benth.*
Nuttallii, *Torr. & Gr.* M. glabella, *Benth.*, *Lab. p.* 371, *excl. syn. Michx.* Hedeoma glabella, *Nutt. excl. syn.* Wet rocks, Niagara Falls. August.

MELISSA, *L.* *Balm.*
§ clinopodium, *Benth.* Clinopodium vulgare, *L.* *Wild Basil.* Rocky banks. July–August.
§ officinalis, *L.* *Common Balm.* Road sides, &c. August.

PRUNELLA, *L.* *Heal-all.*
§? vulgaris, *L.* Open woods, &c. July–September.

SCUTELLARIA, *L.* *Scullcap.*
pilosa, *Michx.* Dry open woods and thickets. June–August.
integrifolia, *L.* Moist thickets. June–July.
galericulata, *L.* Borders of swamps. August.
lateriflora, *L.* *Mad-dog Scullcap.* Low wet grounds. August.
parvula, *Michx.* Shores of Lakes Erie and Ontario. *Dr. Gray.*

LOPHANTHUS, *Benth.*
nepetoides, *Benth.* Hyssopus nepetoides, *L.* Thickets and along fences. July–August.
Var. scrophularifolius. L. scrophularifolius, *Benth.* Hyssopus scrophularifolius, *Willd.* With the preceding.

NEPETA, *L.* *Catnep.*
§ cataria, *L.* *Common Catnep.* Road sides, &c. July–August.
§ glechoma, *Benth.* Glechoma hederacea. *Ground Ivy, Gill.* Road sides, and shady grassy places. May–June.

DRACOCEPHALUM, *L.*
parviflorum, *Nutt.* Barren fields and woods, Jefferson county, *Dr. Crawe, Dr. Gray.* Rocky banks of small lakes, St. Lawrence county. June–August.

PHYSOSTEGIA, *Benth.*
virginiana, *Benth.* Dracocephalum virginianum, *L.* Banks of rivers; western counties. July.

LAMIUM, *L.* *Dead Nettle.*
§ amplexicaule, *L.* Cultivated grounds and fields. April–May.

LEONURUS, *L.* *Motherwort.*
§ cardiaca, *L.* Rubbish and waste places. June.

STACHYS, *L.* *Hedge Nettle.*
palustris, *L.* Low damp grounds. July–August.
aspera, *Michx.* Wet thickets, along rivers. July–August.
hyssopifolia, *Michx.* Wet meadows, Long Island. July.

GALEOPSIS, *L.* *Hemp Nettle.*
§ tetrahit, *L.* Waste places, road sides, &c. July–August.
§ ladanum, *L.* Old fields, northern counties. July.

MARRUBIUM, *L.* *Horehound.*
§ vulgare, *L.* Rocky banks, fields, &c. July–August.

TRICHOSTEMA, *L.*
dichotomum, *L.* Sandy fields. August.

TEUCRIUM, *L.* *Germander.*
canadense, *L.* T. virginicum, *L.* Low grounds. July.

ORDER SOLANACEÆ. THE NIGHTSHADE TRIBE.

SOLANUM, *L.* *Nightshade.*
§ dulcamara, *L.* *Bittersweet.* Road sides and fields. July–Aug.
§ nigrum, *L.* Old fields and waste places. July–August.
carolinianum, *L.* Borders of woods, Long Island. July.

PHYSALIS, *L.* *Winter Cherry.*
viscosa, *L.*, *Aikin.* Road sides, fields, &c. July. I fully agree with Dr. Aikin in his view of this species as given in Eaton's Manual, Ed. 7, p. 436.

NICANDRA, *Adans.*
§ physaloides, *Pers.* Cultivated grounds. July–September.

NICOTIANA, *L.*
§ rustica, *L.* Naturalized in the western part of the State. *Nuttall.*

DATURA, *L.* *Thorn Apple, Jamestown Weed.*
§ stramonium, *L.* Waste grounds. July–September.
Var. tatula. D. tatula, *L.* With the preceding.

HYOSCYAMUS, *L.* *Henbane.*
§ niger, *L.* Road sides, &c. June.

ORDER SCROPHULARIACEÆ. THE FIGWORT TRIBE.

VERBASCUM, *L.* *Mullein.*
§ thapsus, *L.* *Common Mullein.* Old fields, road sides, &c. June.
blattaria, *L.* Road sides, &c. June–July.
§ lychnitis, *L.* Old fields, near Oneida lake. June–July.
Var. hybrida. Intermediate between this species and V. thapsus. With the preceding.

VERONICA, *L.* *Speedwell.*
§ serpyllifolia, *L.* Meadows and pastures. May–August.
scutellata, *L.* Wet meadows and swamps. May–June.
anagallis, *L.* *Water Speedwell.* Ditches. June–August.
beccabunga, *L.* *Brooklime.* Wet places. June.
§ officinalis, *L.* *Common Speedwell.* Dry woods. June.
peregrina, *L.* *Neck-weed.* Cultivated grounds. May.
§ arvensis, *L.* Dry banks and fields. May.
§ hederifolia, *L.* Near Brooklyn, Long Island. April.
virginica, *L.* Leptandra virginica, *Nutt.* Borders of woods, &c. July.

BUCHNERA, *L.*
americana, *L.* Sandy soils, western counties. July.

SCROPHULARIA, *L.* *Figwort.*
marilandica, *L.* S. lanceolata, *Pursh.* Dry woods, and along fences. July–August.

LINARIA, *Tourn.* *Toad Flax.*
§ vulgaris, *Ait.* Antirrhinum linaria, *L.* *Continental Weed, Ransted Weed.* Road sides and fields. June–Oct.
canadensis, *Spreng.* Antirrhinum canadense, *L.* Sandy soils, wet or dry. June–July.
§ elatine, *Desf.* Antirrhinum elatine, *L.* Shore of Cayuga lake. *Dr. Gray.*

MIMULUS, *L.* *Monkey Flower.*
ringens, *L.* Wet grounds. August.
alatus, *L.* Low grounds, along rivers, &c. August.

GRATIOLA, *L.* *Hedge Hyssop.*
virginica, *L.* Overflowed places. July–August.
aurea, *Muhl.* Sandy swamps, Long Island.

LINDERNIA, *L.*
dilatata, *Muhl.* Low wet places. July–August.
attenuata, *Muhl.* With the preceding.

CHELONE, *L.* *Snake-head.*
glabra, *L.* Margin of swamps. August–September.

PENTSTEMON, *L'Her.*
pubescens, *Ait.* Hill sides. June.

COLLINSIA, *Nutt.*
verna, *Nutt.* Rich alluvial soil. Near Utica, May, *Dr. Gray.* Ithaca, *Dr. Aikin.*

LIMOSELLA, *L.* *Mudwort.*
subulata, *Ives.* Muddy banks of rivers. West Point, *Prof. Bailey.*

GERARDIA, *L.*
purpurea, *L.* Borders of swamps. August–September.
maritima, *Raf.* Salt marshes. August–September.
tenuifolia, *Vahl.* Dry woods. August.
flava, *L.* Woods. July–August.
quercifolia, *Pursh.* Woods. August.
pedicularia, *L.* Dry hills and sandy woods. August.

PEDICULARIS, *L.* *Lousewort.*
lanceolata, *Michx.* P. pallida, *Pursh.* Swamps near New-York. September.
canadensis, *L.* P. gladiata, *Michx.* Borders of woods. June.

CASTILLEIA, *Mutis.*
coccinea, *Spreng.* Euchroma coccinea, *Nutt.* Wet meadows. May.

MELAMPYRUM, *L.* *Cow Wheat.*
americanum, *Michx.* Woods. June–July.

ORDER OROBANCHACEÆ. THE BROOM-RAPE TRIBE.

OROBANCHE, *L.* *Broom Rape.*
americana, *L.* *Caveer-root.* Woods. July.
uniflora, *L.* Woods. May–June.

EPIPHEGUS, *Nutt.* *Beech-drops.*
americanus, *Nutt.* Under the shade of beech trees. September.

ORDER VERBENACEÆ. THE VERVAIN TRIBE.

VERBENA, *L.* *Vervain.*
hastata, *L.* Low grounds. July–August.
spuria, *L.* Sandy fields and waste places. August.
urticifolia, *L.* Road sides. July.
angustifolia, *Michx.* Sandy woods and river banks. August.

PHRYMA, *L.* *Lopseed.*
leptostachya, *L.* Borders of woods. July.

ORDER ACANTHACEÆ. THE JUSTICIA TRIBE.

JUSTICIA, *L.*
americana, *Vahl.* In water; western counties. July–August.

ORDER LENTIBULACEÆ.

UTRICULARIA, *L.* *Bladder-wort.*
inflata, *Walt.* U. ceratophylla, *Michx.* Ponds, Long Island. July.
vulgaris, *L.* Ponds and slow streams. August.
intermedia, *Hayne.* Swamps, Jefferson county. June–July. *Dr. Gray.*
minor, *Willd.* With the preceding, *Dr. Gray.* Near Albany, *Dr. Beck.*
cornuta, *Michx.* Swamps. August.

PINGUICULA, *Butter-wort.*
vulgaris, *L.* Wet rocks, Genesee Falls. May. *Prof. Hadley.*

ORDER PRIMULACEÆ. THE PRIMROSE TRIBE.

PRIMULA, *L.* *Primrose.*
mistassinica, *Michx.* Yates county. *Dr. Sartwell.*

TRIENTALIS, *L.* *Chickweed, Wintergreen.*
americana, *Pursh.* Wet woods and swamps. May.

HOTTONIA, *L.* *Water Feather.*
inflata, *Ell.* Stagnant water, Westchester county. *Beck.*

LYSIMACHIA, *L.* *Loosestrife.*
stricta, *Ait.* Low grounds. July.
quadrifolia, *L.* Borders of woods, &c. June–July.
ciliata, *L.* Borders of woods and streams. June–July.
thyrsiflora, *L.* Marshes. June.
revoluta, *Nutt.* Wet rocks, Niagara Falls. August.

ANAGALLIS, *L.* *Pimpernel.*
§ arvensis, *L.* *Red Chickweed.* Road sides and fields. June–September.

SAMOLUS, *L.* *Water Pimpernel.*
valerandi, *L.* Wet grounds. July–September.

ORDER PLUMBAGINACEÆ. THE LEADWORT TRIBE.

STATICE, *L.* *Marsh Rosemary.*
limonium, *L.* Borders of salt marshes. August–October.

ORDER PLANTAGINEÆ. THE PLANTAIN TRIBE.

PLANTAGO, *L.* *Plantain.*
cordata, *Lam.* Banks of streams, near New-York and Fishkill. June.
§ major, *L.* *Common Plantain.* Fields, road sides, &c. June–September.
virginica, *L.* Sterile fields and dry hills. May–June.
§ lanceolata, *L.* *Narrow-leaved Plantain, Ripple Grass.* Fields and meadows. May–August.
maritima, *L.* Salt marshes. August–September.
pusilla, *Nutt.* Arid hills, Island of New-York. May. Is this a dwarf form of P. sparsiflora, *Michx.?*

ORDER AMARANTHACEÆ. THE AMARANTH TRIBE.

AMARANTHUS, *L.*
§ albus, *L.* Cultivated grounds. August.
§ hybridus, *L.* Gardens and waste grounds. August.
§ retroflexus, *L.* Waste grounds and cultivated fields. August.
pumilus, *Nutt.* Sandy coast of Long Island. August.

ORDER CHENOPODIACEÆ. THE GOOSEFOOT TRIBE.

CHENOPODIUM, *L.* *Goosefoot.*
§ ambrosioides, *L.* Road sides. August–September.
§ album, *L.* Cultivated grounds, and about houses. July–Sept.
§ anthelminticum, *L.* *Wormseed.* Road sides. August–Sept.
§ botrys, *L.* *Jerusalem Oak.* Road sides. August.
§ hybridum, *L.* Fields and waste grounds. August.
§ rubrum, *L.?* Western part of the State. August.

SHOBERIA, *C. A. Meyer.*
maritima, *C. A. Meyer.* Chenopodium maritimum, *L.* Salt marshes. August–September.

ATRIPLEX, *L.* *Orach.*
laciniata, *L.* Borders of salt marshes. August.
arenaria, *Nutt.* Sea beach of Long Island. August–September.

ACNIDA, *L.* *Water Hemp.*
cannabina, *L.* Borders of salt marshes. July–August. A. ruscocarpa, *Michx.* seems to be scarcely distinct from this.

SALICORNIA, *L.* *Glasswort.*
herbacea, *L.* Salt marshes. August–September.

SALSOLA, *L.* *Saltwort.*
soda, *L.* S. caroliniana, *Michx.* Sandy shores about New-York, and on the seacoast of Long Island. Near West Point, *Prof. Bailey.* August–September.

BLITUM, *L.*
§? capitatum, *L.* *Strawberry Blite.* Banks of rivulets. June.
maritimum, *Nutt.* Salt marshes near New-York. Atriplex?

ORDER PHYTOLACCACEÆ. THE POKEWEED TRIBE.

PHYTOLACCA, *L.* *Poke,* or *Pokeweed.*
decandra, *L.* Hill sides, borders of fields, &c. June–October.

ORDER POLYGONACEÆ. THE BUCKWHEAT TRIBE.

POLYGONUM, *L.* *Knot-weed.*
§ aviculare, *L.* About houses, road sides, &c. June–October.
Var. glaucum. P. glaucum, *Nutt.* Seacoast. August–Sept.
§ erectum, *L.* Road sides, waste places, &c. August–Sept.
tenue, *Michx.* Rocky hills and dry banks. July–August.
virginianum, *L.* Rocky woods in rich soil. July–August.
hydropiper, *L.* P. hydropiperoides, *Pursh.* *Water Pepper.* Low wet grounds. August.
mite, *Pers.* P. hydropiperoides, *Michx.* Swamps. August–September.
§ persicaria, *L.* *Lady's Thumb.* Waste places, and gardens. July–September.
amphibium, *L.*
Var. 1. natans, *Michx.* Floating in ponds. August.

POLYGONUM, (continued.)

Var. 2. emersum, *Michx.* P. coccineum, *Willd.* Margin of ponds and rivers. August–September.

Var. 3. strigosum. Head of Seneca lake. *Dr. Gray.*

Var. 4. acuminatum. Cayuga lake. *Dr. Aikin.*

pennsylvanicum, *L.* Borders of fields, wet thickets, &c. July–August.

§ orientale, *L.* *Prince's Feather.* Cultivated grounds. July–September.

sagittatum, *L.* Wet thickets. August.

arifolium, *L.* Wet thickets and river banks. August.

scandens, *L.* *Climbing Buckwheat.* Shady thickets, &c. Aug.

§ convolvulus, *L.* *Black Bindweed.* Cultivated grounds. July.

§ fagopyrum, *L.* *Buckwheat.* Fields. Scarcely naturalized. September.

cilinode, *Michx.* Rocky thickets, northern counties. July.

RUMEX, *L.* *Dock.*

§ crispus, *L.* *Curled Dock.* Fields. June–July.

§ obtusifolius, *L.* Fields and borders of woods. June–July.

verticillatus, *L.* Swamps. June–July.

britannica, *L.* *Yellow-rooted Water Dock.* Swamps. June–July.

§ acetosella, *L.* *Sheep Sorrel.* Fields and road sides. May–July.

ORDER LAURACEÆ. THE CINNAMON TRIBE.

LAURUS, *L.*

benzoin, *L.* *Wild Allspice, Fever Bush, Benjamin Tree.* Swamps. April.

sassafras, *L.* *Common Sassafras.* Woods. April.

ORDER ELEAGNACEÆ. THE OLEASTER TRIBE.

SHEPHERDIA, *Nutt.*

canadensis, *Nutt.* Rocky banks of streams and lakes, northern and western counties. May.

ORDER THYMELACEÆ. THE MEZEREUM TRIBE.

DIRCA, *L.* *Leather-wood.*
palustris, *L.* Woods, near streams. April.

ORDER SANTALACEÆ. THE SANDERS-WOOD TRIBE.

NYSSA, *L.*
multiflora, *Walt.* N. sylvatica, *Michx. sylv.* N. villosa, *Willd.* *Black Gum.* Woods. May–June.

COMANDRA, *Nutt.*
umbellata, *Nutt.* *Bastard Toad-flax.* Rocky hills. June.

ORDER ARISTOLOCHIACEÆ. THE BIRTHWORT TRIBE.

ARISTOLOCHIA, *L.*
serpentaria, *L.* *Virginia Snake-root.* Shady woods. June.

ASARUM, *L.*
canadense, *L.* *Wild Ginger, Coltsfoot.* Rocky woods. May.

ORDER EMPETRACEÆ. THE CROWBERRY TRIBE.

EMPETRUM, *L.* *Crowberry.*
nigrum, *L.* Summit of Mount Marcy and Mount McIntyre. July. Found also on Whiteface Mountain, by *Dr. Emmons* and *Prof. Hall.*

ORDER EUPHORBIACEÆ. THE EUPHORBIUM TRIBE.

ACALYPHA, *L.* *Three-seeded Mercury.*
virginica, *L.* Fields and road sides. June–August.

EUPHORBIA, *L.* *Spurge.*
hypericifolia, *L.* E. maculata, *Michx.* Road sides and sandy fields. July–September.
maculata, *L.* E. depressa, *Torr. in Ell. sk.* Cultivated grounds and sandy fields. July–September.
polygonifolia, *L.* E. maritima, *Nutt.* Seacoast. August.
obtusata, *Pursh.* Sandy fields and river banks. July–August.

ORDER URTICACEÆ. THE NETTLE TRIBE.

URTICA, *L.* *Nettle.*
pumila, *L.* Wet grounds. July–August.
§ dioica, *L.* *Stinging Nettle.* Waste grounds, road sides, &c. July.
canadensis, *L.* U. divaricata, *L.* Shady rocky places, along streams. July–August.

BŒHMERIA, *Willd.*
cylindrica, *Willd.* Moist shady woods and thickets. July–Aug.

PARIETARIA, *L.* *Pellitory.*
pennsylvanica, *Muhl.* Shady rocky hill sides. July.

CANNABIS, *L.* *Hemp.*
§ sativa, *L.* Fields, and along fences. June–July.

HUMULUS, *L.* *Hop.*
§ lupulus, *L.* Borders of woods and rivers. August.

MORUS, *L.* *Mulberry.*
rubra, *L.* *Red Mulberry.* Woods. May.
§ alba, *L.* *White Mulberry.* About houses: naturalized in some places. May.

ORDER SAURURACEÆ.

SAURURUS, *L.* *Lizard's-tail.*
cernuus, *L.* Swamps and borders of streams. July.

ORDER PODOSTEMACEÆ.

PODOSTEMUM, *Michx.*
ceratophyllum, *Michx.* Lacis ceratophylla, *Bong.* On stones in Black river. *Dr. Crawe.*

ORDER AMENTACEÆ.

SUB-ORDER CUPULIFERÆ. THE NUT TEIBE.

CARPINUS, *L.* *Hornbeam.*
americana, *Michx.* Rocky woods. April.

OSTRYA, *Scop.* *Hop Hornbeam.*
virginica, *Willd.* *Iron-wood.* Rocky woods. April–May.

CORYLUS, *L.* *Hazel-nut.*
americana, *Walt.* *Wild Filbert.* Thickets, &c. April.
rostrata, *Ait.* Mountain woods. April.

FAGUS, *L.* *Beech.*
sylvatica, *L.* F. sylvestris, *Michx. f. sylv.* *Common Beech, White Beech.* Woods, in fertile soil. May.

CASTANEA, *Gært.* *Chestnut.*
vesca, var. americana, *Michx.* *Chestnut.* Woods. June.
pumila, *Michx.* *Chinquapin.* Woods, Long Island. *Mr. W. R. Prince.*

QUERCUS, *L.* *Oak.*
tinctoria, *Bartr.* *Black Oak, Quercitron.* Woods. May.
rubra, *L.* *Red Oak.* Dry hilly woods. May.
palustris, *Michx.* *Water* or *Pin Oak.* Borders of swamps.
ilicifolia, *Willd.* Q. banisteri, *Michx.* *Barren Scrub Oak.* Sandy woods, and on mountains. May.
stellata, *Willd.* Q. obtusiloba, *Michx.* *Post Oak.* Sandy woods, Long Island.
olivæformis, *Michx. f. sylv.* Banks of the Hudson, near Albany. This has not been found by any other botanist than the younger Michaux.
alba, *L.* *White Oak.* Woods.
bicolor, *Willd.* *Swamp White Oak.* Borders of swamps.
montana, *Willd.* *Rock Chestnut Oak.* Rocky woods, along rivers.
prinoides, *Willd.* Q. chinquapin, *Michx. f.* *Dwarf Chestnut Oak.* Sandy woods.
coccinea, *Wang.* *Scarlet Oak.* Woods.

SUB-ORDER BETULEÆ. THE BIRCH TRIBE.

BETULA, *L.* *Birch.*
populifolia, *Ait.* *White Birch.* Rocky and sandy woods.
papyracea, *Ait.* *Canoe Birch.* Forests in the north part of the State.

BETULA, (continued.)

lenta, *L.* B. carpinifolia, *Michx.* *Cherry Birch, Sweet Birch.* Woods.

excelsa, *Ait.* B. lutea, *Michx. f. sylv.* *Yellow Birch.* Woods, and borders of swamps.

nana, *L.* *Dwarf Birch.* High mountains of Essex county.

ALNUS, *Willd.* *Alder.*

serrulata, *Willd.* *Common Alder.* Swamps and wet thickets. March.

incana, *Willd.?* Sources of the Hudson, Essex county.

SUB-ORDER SALICINEÆ. THE WILLOW TRIBE.

SALIX, *L.* *Willow.*

§ viminalis, *L.* *Osier, Basket Willow.* Banks of streams. April.
Muhlenbergiana, *Willd.* Dry woods and sandy thickets. April.
tristis, *Muhl.* Dry woods. April–May.
pedicellaris, *Pursh.* Swamps, usually on mountains. May.
conifera, *Wang.* S. eriocephala, *Michx.?* Wet thickets. April.
myricoides, *Muhl.* Swamps. April.
prinoides, *Pursh.* Swamps. April. Distinct from the preceding?
discolor, *Willd.* Low grounds. April.
longifolia, *Muhl.* River banks. May.
§ babylonica, *L.* *Weeping Willow.* About houses. April.
nigra, *Marsh.* Banks of streams. May.
longirostris, *Michx.* Wet thickets and woods. April.
rigida, *Muhl.* Borders of swamps. April.
lucida, *Muhl.* With the preceding. April.
cordata, *Muhl.* Low wet grounds. April.
grisea, *Willd.* Low grounds. April.
§ vitellina, *L.* About houses, and along brooks. April.
uva-ursi. *Pursh?* Mount Marcy. July. Whiteface Mountain, *Dr. Emmons.*

I have several other undetermined species of Willow, collected in this State.

POPULUS, *L.* *Poplar.*

balsamifera, *Michx.* *Balsam Poplar, Tacamahac.* Shores of Lake Champlain. *Michx. f.*

§ candicans, *Ait.* About houses. April.

Populus, (continued.)

tremuloides, *Michx.* *American Aspen.* Dry woods. April.

tremula, *L.* P. grandidenta, *Michx.* *Large Aspen.* Woods.

lævigata, *Ait.* P. canadensis, *Michx. f.* *Cotton-wood.* Western part of New-York. *Michaux.*

nigra, *Michx.* P. hudsonica, *Michx. sylv.* P. betulifolia, *Pursh.* *Black Poplar.* Banks of the Hudson above Albany, *Michx. fil.* Borders of Oneida lake.

SUB-ORDER MYRICEÆ. THE GALE TRIBE.

MYRICA, *L.*

gale, *L.* *Sweet Gale.* Borders of lakes, generally in mountainous tracts. May.

cerifera, *L.* *Bayberry, Wax Myrtle.* Woods and thickets. May.

COMPTONIA, *Banks.*

asplenifolia, *Ait.* *Sweet Fern.* Dry woods. April–May.

SUB-ORDER PLATANEÆ. THE PLANE TRIBE.

PLATANUS, *L.* *Plane Tree.*

occidentalis, *L.* *Button-wood, Sycamore.* Banks of rivers. May.

SUB-ORDER STYRACIFLUEÆ.

LIQUIDAMBAR, *L.* *Sweet Gum Tree.*

styraciflua, *L.* *Bilested.* Woods. April.

ORDER ULMACEÆ. THE ELM TRIBE.

ULMUS, *L.* *Elm.*

americana, *L.* *White Elm.* Low woods. April–May.

fulva, *Michx.* U. rubra, *Michx. f. sylv.* *Slippery Elm, Red Elm.* Rocky banks of rivers. April.

racemosa, *Thomas.* Western counties, *Mr. Thomas, Dr. Kneiskern.*

CELTIS, *L.* *Hackberry.*

occidentalis, *L.* *Hoop Ash, Beaver-wood.* Woods. May.

ORDER JUGLANDACEÆ. THE WALNUT TRIBE.

JUGLANS, *L.* *Walnat.*
nigra, *L.* *Black Walnut.* Woods. May.
cinerea, *L.* *Butternut.* Woods. May.

CARYA, *Nutt.* *Hickory.*
sulcata, *Nutt.* Juglans laciniosa, *Michx. sylv.* *Thick Shell-bark Hickory.* Fertile woods.
alba, *Nutt.* Juglans squamosa, *Michx. sylv.* *Shell-bark Hickory, Kiskytom.* Fertile woods.
tomentosa, *Nutt.* *Common Hickory, Mochee-nut.* Woods.
amara, *Nutt.* *Bitter-nut.* Dry woods. May.
porcina, *Nutt.* *Pig-nut, Broom Hickory.* Dry fertile woods.

CLASS II. GYMNOSPERMS.

ORDER CONIFERÆ. THE FIR TRIBE.

PINUS, *L.* *Pine.*
resinosa, *Ait.* P. rubra, *Michx. f. sylv.* *Red Pine.* Heldeberg mountain. *Beck.*
rigida, *L.* *Pitch Pine.* Woods, in poor soil.
strobus, *L.* *White Pine, Weymouth Pine.* Fertile soils, and swamps.
variabilis, *Lamb.* P. mitis, *Michx.* *Yellow Pine.* Banks of the Hudson, a little below Albany. *Michx. fil.*

ABIES, *Juss.* (ABIES and LARIX, *Tourn.*)
nigra, *Michx. f. sylv.* A. denticulata, *Michx. fl.* Pinus nigra, *Ait.* *Black* or *Double Spruce.* Wet rocky soils and swamps. The Red Spruce, Pinus rubra, *Lamb.* appears to be only a variety of this species.
alba, *Michx.* Pinus alba, *Ait.* *White* or *Single Spruce.* Rocky damp soils and swamps.
balsamea, *Mill.* A. balsamifera, *Michx.* Pinus balsamea, *Ait.* Mountains. Not found south of Catskill.
canadensis, *Michx.* Pinus canadensis, *L.* *Hemlock Spruce.* Rocky woods, and along mountain ravines.
pendula. Pinus pendula, *Ait.* Larix americana, *Michx.* *American Larch, Tamarack, Hackmatack.* Swamps.

THUYA, *L.* *Arbor Vitæ.*
occidentalis, *L.* Rocky hills, along rivers. May.

CUPRESSUS, *L.* *Cypress.*
thuyoides, *L.* *White Cedar.* Swamps, Long Island. May.

JUNIPERUS, *L.* *Juniper.*
virginiana, *L.* *Red Cedar.* Rocky banks and dry hills. Sir W. Hooker considers this species as identical with J. sabina. May.
communis, *L.* *Common Juniper.* Dry rocky woods. May.

SUB-ORDER TAXINEÆ.

TAXUS, *L.* *Yew.*
canadensis, *L.* *American Yew, Running* or *Ground Hemlock.* Moist rocky places. April.

CLASS III. ENDOGENS, OR MONOCOTYLEDONS.

ORDER AMARYLLIDACEÆ. THE NARCISSUS TRIBE.

HYPOXIS, *L.* *Star Grass.*
erecta, *L.* Woods. May–July.

ORDER IRIDACEÆ. THE IRIS TRIBE.

SISYRINCHIUM, *L.* *Blue-eyed Grass.*
anceps, *L.* Meadows. July.
Var. mucronatum. S. mucronatum, *Michx.* Sandy woods, Long Island, &c.

IRIS, *L.*
versicolor, *L.* I. virginica, *Pursh.* *Blue Flag.* Wet grounds. June–July.
virginica, *L.* I. prismatica, *Pursh.* I. gracilis, *Bigel.* Margins of swamps. June.

ORDER HYDROCHARACEÆ. THE FROG-BIT TRIBE.

HYDROCHARIS, *L.* *Frog's-bit.*
cordifolia, *Nutt.* Braddock's Bay, Lake Ontario. *Dr. Bradley.*

UDORA, *Nutt.*

canadensis, *Nutt.* Elodea canadensis, *Michx.* Lakes and still water. August.

VALISNERIA, *L.*

spiralis, *L.* V. americana, *Michx.* Slow flowing water. Common in the Hudson north of the Highlands. Aug.

ORDER ORCHIDACEÆ. THE ORCHIS TRIBE.

HABENARIA, *Willd., R. Br.*

§ 1. *Platanthera,* Rich., Lindl.

orbiculata, *Torr.* Orchis macrophylla, *Goldie.* Woods. June–July.

Hookeriana, *Torr.* Orchis orbiculata, *Hook.* Woods. June.

ciliaris, *R. Br.* Swamps. July–August.

blephariglottis, *Hook.* Swamps. July–August.

dilatata, *Spreng.* Swamps, northern counties. June–July.

hyperborea, *R. Br.* Swamps. June–July.

flava, *Gray in Sill. Jour.* 1840. Orchis flava, *L.* Habenaria herbiola, *R. Br.* Moist woods. June–July.

psycodes, *Gray, l. c.* Orchis psycodes, *L.* O. fimbriata, *Ait.* O. fissa and incisa, *Muhl.* and *Willd.*

Var. grandiflora, *Gray, l. c.* Orchis grandiflora, *Bigel.* Meadows and swamps. June–July.

lacera, *Gray, l. c.* Orchis lacera, *Michx.* O. psycodes, *Willd.;* not of *Linn.*

obtusata, *R. Br.* Sphagnous swamps and wet woods, northern counties. June–July.

§ 2. *Peristylus,* Lindl.

bracteata, *R. Br.* Shady woods. June.

tridentata, *Hook.* Swamps. July–August.

ORCHIS, *L.*

spectabilis, *L.* Rocky woods. May.

MICROSTYLIS, *Nutt.*

ophioglossoides, *Nutt.* Swamps, and about the roots of trees. June.

brachypoda, *Gray.* Deep shady swamps. Fairfield, Herkimer county, *Prof. Hadley.* Oneida county, *Dr. Gray* and *Dr. Bradley.* July.

LIPARIS, *Rich.*

liliifolia, *Rich.* Malaxis liliifolia, *Sw.* Swamps and shady woods. June–July.

loeseli, *Rich.* Malaxis correana, *Bart.* Swamps. Clinton, Oneida county, *Dr. Bradley.*

TIPULARIA, *Nutt.*

discolor, *Nutt.* Parma, Monroe county. July. *Dr. Bradley.*

APLECTRUM, *Nutt.*

hyemale, *Nutt.* *Putty-root, Adam & Eve.* Shady fertile woods, northern and western counties. July. *Dr. Gray* and *Dr. Bradley.* Washington county, *Dr. Stevenson.*

CORALLORHIZA, *Swartz.* *Coral-root.*

verna, *Nutt.* Sphagnous swamps. May.

odontorhiza, *Nutt.* Damp fertile woods. August–September.

multiflora, *Nutt.* Woods. August–September.

The last two species may not be distinct.

ARETHUSA, *L.*

bulbosa, *L.* Sphagnous swamps. June.

POGONIA, *Juss.*

ophioglossoides, *R. Br.* Swamps. June–July.

verticillata, *Nutt.* Swamps. Oneida county, *Dr. Kneiskern.* Eaton, Madison county, *Dr. Bradley.*

TRIPHORA, *Nutt.*

pendula, *Nutt.* Rocky woods. June–July.

CALOPOGON, *R. Br.*

pulchellus, *R. Br.* Swamps. June–July.

SPIRANTHES, *Rich.*

tortilis, *Rich.* Neottia tortilis, *Sw.* Moist grounds, open woods, &c. July–August.

Var. gracilis, *Torr.* Neottia gracilis, *Bigel.* With the preceding.

cernua, *Rich.* Neottia cernua, *Sw.* Swamps and wet thickets. August–September.

Var.? latifolia, *Torr.* S. æstivalis, *Rich.?* Swamps; particularly on mountains. July.

LISTERA, *R. Br.*
cordata, *R. Br.* Sphagnous swamps. June–July.

GOODYERA, *R. Br.*
pubescens, *R. Br.* Shady fertile woods. July–August.
repens, *R. Br.* Shady moist woods, northern counties. July.

CYPRIPEDIUM, *L.* *Ladies' Slipper.*
pubescens, *Willd.* C. parviflorum, *Ait.* *Mocasin Flower*, *Noah's Ark.* Rocky moist woods. May.
acaule, *Ait.* Dry woods and sandy thickets. May.
spectabile, *Sw.* Swamps. June–July.
arietinum, *Ait.* Near Oneida lake. *Dr. Gray.*

ORDER PONTEDERIACEÆ.

PONTEDERIA, *L.*
cordata, *L.* *Pickerel-weed.* In water. July–August.
Var. angustifolia, *Torr.* P. angustifolia, *Pursh.* Mountain lakes. *Pursh.*

SCHOLLERA, *Schreb.*
graminifolia, *Muhl.* Leptanthus gramineus, *Michx.* In flowing waters. July–August.

HETERANTHERA, *Ruiz* and *Pavon.*
reniformis, *R. & P.* Leptanthus reniformis, *Michx.* Muddy banks of rivers, Fishkill, Hudson, &c. July–August.

ORDER MELANTHACEÆ. THE COLCHICUM TRIBE.

ZIGADENUS, *Michx.*
glaucus, *Nutt.* Shore of Lake Erie. *Dr. Beck.*

LERMANTHIUM, *Willd.*
virginicum, *Willd.* Melanthium virginicum, *L.* Wet meadows. Orange county. *Dr. Horton,* fide *Beck.* Is not this L. hybridum?

VERATRUM, L. *White Hellebore.*
virida, *Ait.* Swamps. May.

Helonias, *L.*, *Gray.*
dioica, *Pursh.* Veratrum luteum, *L.* *Blazing Star*, *Devil's-bit.* Wet meadows and borders of woods. May–June.

Order TRILLIACEÆ.

Trillium, *L.* *Three-leaved Nightshade.*
erythrocarpum, *Michx.* T. pictum, *Pursh.* Shady woods. May.
erectum, *L.* T. atropurpureum, *Curt.* Shady rocks. May.
Var. 1. album, *Pursh.* T. pendulum, *Willd.* Western counties.
Var. 2. flavum. Hamilton, Madison county. *Dr. Douglass.*
cernuum, *L.* Woods. May.
grandiflorum, *Salisb.* Shady woods, in rich soil. May.

Medeola, *L.* *Indian Cucumber.*
virginica, *L.* Rocky woods and thickets. June.

Order LILIACEÆ. The Lily Tribe.

Lilium, *L.* *Lily.*
philadelphicum, *L.* Thickets and borders of woods. June.
canadense, *L.* Wet meadows. June–July.
superbum, *L.* Wet meadows. July.

Erythronium, *L.* *Dog's-tooth Violet.*
americanum, *Smith.* Wet meadows and woods. April.
albidum, *Nutt.* Near Albany. *Dr. Beck* and *Dr. Eights.*

Allium, *L.*
canadense, *L.* Jefferson county. *Dr. Crawe.*
§ vineale, *L.* *Wild Garlic.* Pastures and meadows. June–July.
tricoccum, *Ait.* *Wild Leek.* Woods, in rich soil; western and northern counties. July.

Aletris, *L.* *Star Grass.*
farinosa, *L.* *Colic-root.* Sandy thickets. June.

Convallaria, *L.*

§ *Polygonatum*, Desf.

multiflora, *L.* C. polygonatum, *Muhl.* C. pubescens, *Willd.* Polygonatum canaliculatum & latifolium, *Pursh.* Rocky woods, &c. May–June.

CONVALLARIA, (continued.)

§ *Maianthemum*, Desf.

bifolia, *L.* Shady woods, about the roots of trees. May.

§ *Smilacina*, Desf.

stellata, *L.* Rocky banks. May–June.

trifolia, *L.* Sphagnous swamps, northern and western counties. June.

racemosa, *L.* Rocky woods, in rich soil. June–July.

§ *Clintonia*, Raf.

borealis. Dracæna borealis, *Ait.* Clintonia borealis, *Raf.* Moist rocky woods, &c. June.

STREPTOPUS, *Michx.*

roseus, *Michx.* Rocky woods, particularly on mountains. May–June.

amplexifolius, var. americanus, *Gray.* S. distortus, *Michx.* Deep swamps, near Utica. Near Fairfield, *Prof. Hadley*.

lanuginosus, *Michx.* Cattaraugus and Monroe counties, *Dr. Bradley*. Near Rochester, *Dr. Harris*. Near Auburn, *Mr. Carey*.

UVULARIA, *L.* *Bellwort.*

perfoliata, *L.* Woods and rocky banks. May.

Var. major, *Michx.* U. grandiflora, *Smith.* Western counties. Also near Albany.

sessilifolia, *L.* Woods. May.

ASPARAGUS, *L.*

§ officinalis, *L.* *Common Asparagus.* Borders of salt marshes, Long Island, and near New-York. June.

ORNITHOGALUM, *L.* *Star of Bethlehem.*

§ umbellatum, *L.* Pastures and wet meadows. May.

ORDER COMMELINACEÆ. THE SPIDER-WORT TRIBE.

TRADESCANTIA, *L.* *Spider-wort.*

virginica, *L.* Near Buffalo, *Dr. Kinnicutt*. May.

ORDER ALISMACEÆ. THE WATER-PLANTAIN TRIBE.

SAGITTARIA, *L.* *Arrow-head.*

sagittifolia, *L.* Ditches and wet grounds. July–August.

Var. 1. vulgaris, *Hook.* S. sagittifolia, *Ph.*

— 2. latifolia, *Torr.* Var. macrophylla, *Hook.* S. latifolia and obtusa, *Ph.*

— 3. pubescens, *Torr.*

— 4. hastata, *Torr.* S. hastata, *Pursh.*

— 5. gracilis, *Torr.* S. gracilis and heterophylla, *Ph.*

— 6. simplex, *Hook.* S. simplex, graminea & acutifolia, *Ph.*

— 7. rigida, *Torr.* S. rigida, *Pursh.*

pusilla, *Nutt.* Muddy banks of streams. August.

ALISMA, *L.* *Water Plantain.*

plantago, *L.* A. parviflora, *Pursh.* In water. July–August.

ORDER JUNCEÆ. THE RUSH TRIBE.

LUZULA, *D. C.*

campestris, *D. C.* Meadows and dry woods. April–May.

pilosa, *Willd.* Open woods, banks of rivers, &c. Northern and western counties. May.

melanocarpa, *Desv.* High mountains of Essex county. July.

JUNCUS, *L.* *Rush.*

effusus, *L.* Low wet grounds. June.

filiformis, *L.* Borders of lakes, northern and western counties. July.

balticus, *Willd.* Sandy shore of Lake Erie and the St. Lawrence. July.

nodosus, *L.* J. polycephalus, *Michx.* J. echinatus, *Ell.?* Wet meadows and swamps. June.

tenuis, *Willd.* Low grounds, and in dry places. June–July.

acuminatus, *Michx.* Borders of ponds, &c. July.

marginatus, *Rostk.* Sandy wet places. June–July.

bufonius, *L.* Wet low grounds. July.

trifidus, *L.* Summit of Mount Marcy, Essex county.

bulbosus, *L.* Salt marshes. July–August.

stygius, *L.* Sphagnous swamps, near Perch lake, Jefferson county. August. *Dr. Gray.*

ORDER RESTIACEÆ.

SUB-ORDER ERICAULONEÆ.

ERIOCAULON, *L.* *Pipewort.*
septangulare, *With.* E. pellucidum, *Michx.* Ponds and muddy banks. August.

ORDER XYRIDACEÆ.

XYRIS, *L.* *Yellow-eyed Grass.*
caroliniana, *Walt.* Sandy swamps, Long Island. July.

ORDER SMILACEÆ. THE SMILAX TRIBE.

SMILAX, *L.* *Rough Bindweed.*
rotundifolia, *L.* *Cat Brier*, *Green Brier.* Thickets and woods. June.
caduca, *L.* Sandy fields and hill sides. June. Perhaps not distinct from the preceding.
herbacea, *L.* Meadows and borders of woods. May–June.

ORDER DIOSCOREACEÆ. THE YAM TRIBE.

DIOSCOREA, *L.* *Yam.*
villosa, *L.* Thickets. June–July.

ORDER ARACEÆ. THE ARUM TRIBE.

ARUM, *L.*
dracontium, *L.* *Green Dragon*, *Dragon-root.* Low grounds. Valley of the Mohawk, &c. May–June.
triphyllum, *L.* *Indian Turnip.* Moist shady places. May.

PELTANDRA, *Raf.*
virginica, *Raf.* Arum virginicum, *L.* Lecontea virginica, *Cooper.* Rensselaeria virginica, *Beck.* Swamps and wet shady thickets. June–July.

CALLA, *L.* *Water Arum.*
palustris, *L.* Swamps; northern counties. July.

SYMPLOCARPUS, *Salisb.* *Skunk Cabbage.*
fœtida, *Nutt.* Low grounds. February–March.

Orontium, *L.* *Golden Club, Floating Arum.*
aquaticum, *L.* In shallow water. May.

Acorus, *L.* *Calamus, Sweet Flag.*
calamus, *L.* Wet meadows and swamps. May–June.

Order TYPHACEÆ. The Cat-tail Tribe.

Typha, *L.* *Cat-tail, Reed Mace.*
latifolia, *L.* Borders of swamps and rivers. June–July.
angustifolia, *L.* With the preceding.

Sparganium, *L.* *Burr Reed.*
ramosum, *L.* In shallow ponds and streams. June.
simplex, *Smith.* S. americanum, *Nutt.* Borders of streams. July.

Order FLUVIALES.

Najas, *L.*
canadensis, *Michx.* Ponds and slow-flowing water. July.

Zostera, *L.* *Grasswrack.*
marina, *L.* Seashore and salt-water bays.

Zannichellia, *L.* *Triple-headed Pondweed.*
palustris, *L.* Z. intermedia, *Torr.* Ditches and shallow ponds; most common in brackish water. July.

Ruppia, *L.*
maritima, *L.* Salt-water ditches. July.

Potamogeton, *L.* *Pondweed.*
natans, *L.* Ponds and slow-flowing water. July.
heterophyllus, *Schreb.?* P. fluitans of American botanists. Ponds, &c.
diversifolius, *Bart.* Flowing water. July–August.
perfoliatus, *L.* Flowing water. July.
prælongus, *Wulff.* P. luceus of American botanists. Slow-flowing deep water. July–August.
compressus, *L.* P. zosteræfolius, *Schum.?* Flowing water. July.
gramineus, *Michx.* P. pauciflorus, *Pursh.* Small streams. July–August.
pectinatus, *L.* P. marinus, *Michx.* Fresh and brackish water. July.

ORDER JUNCAGINACEÆ. THE ARROW-GRASS TRIBE.

TRIGLOCHIN, *L.* *Arrow Grass.*
palustre, *L.* Marshes. Near Buffalo, *Dr. Kinnicut.* Salina.
maritimum, *L.* Salt marshes, near New-York and Salina. July.
elatum, *Nutt.* Marshes. Gorham, *Dr. Aikin.* Near Bridgewater, &c. *Dr. Gray.* June–July.

SCHEUCHZERIA, *L.*
palustris, *L.* Sphagnous swamps; western and northern counties. July. Near Albany, *Dr. Beck.*

ORDER PISTIACEÆ. THE DUCKWEED TRIBE.

LEMNA, *L.* *Duckweed, Duck's-meat.*
polyrrhiza, *L.* Ditches and stagnant waters.
gibba, *L.* Near Liverpool, Onondaga county. *Pursh.*
minor, *L.* Stagnant waters.
trisulca, *L.* Ditches and ponds. July.

ORDER CYPERACEÆ. THE SEDGE TRIBE.

DULICHIUM, *Rich.*
spathaceum, *Pers.* Borders of ponds, &c. August–September.

CYPERUS, *L.* *Galingale.*
flavescens, *L.* Boggy places, especially near salt water. August–September.
diandrus, *Torr.* Wet places, near salt water. September.
Var. castaneus, *Torr.* Muddy and sandy shores. August–September.
Nuttallii, *Torr.* Borders of salt marshes. August.
Michauxianus, *Schultz.* Borders of salt marshes. August.
strigosus, *L.* Low moist grounds. August.
repens, *Ell.* C. phymatodes, *Muhl.* Wet sandy places. August.
filiculmis, *Vahl.* C. mariscoides, *Ell.* Dry sterile soils. Sept.
Grayii, *Torr.* Sandy fields, Long Island. August–September.
dentatus, *Torr.* Sandy wet places. September.
inflexus, *Muhl.* C. uncinatus, *Pursh.* Sandy banks of rivers and lakes, north and west of Albany. Albany. Aug.
Schweinitzii, *Torr.* Sandy shore of Lake Ontario, near Braddock's Bay. *Dr. Bradley.*

CYPERUS, (continued.)

ovularis, *Torr.* Mariscus ovularis, *Vahl.* Sandy soils, in dry and moist situations. August–October.

MARISCUS, *Vahl.*

retrofractus, *Vahl.* Sandy soils, near New-York. July.

FUIRENA, *Rottb.*

squarrosa, var. γ. *Torr. Cyp.* Bogs and swamps, Long Island.

Var. 2. pumila, *Torr. Cyp.* Wet sandy places, Long Island. August–September.

ELEOCHARIS, *R. Br.*

palustris, *R. Br.* Low wet places. May–June.

olivacea, *Torr.* Sandy swamps, Long Island. July.

intermedia, *Schultes.* Wet places, and in shallow running water. Oneida county. *Dr. Gray.*

obtusa, *Schultes.* Scirpus capitatus, *Walt.;* not of *Linn.* Bogs and ditches. July.

tuberculosa, *R. Br.* Sandy swamps, Long Island. August.

acicularis, *R. Br.* Borders of ponds. June.

tenuis, *Schultes.* Bogs and margin of swamps. May.

pygmæa, *Torr.* Salt marshes, near New-York. August.

SCIRPUS, *L.* *Club-rush.*

planifolius, *Muhl.* Dry woods and bogs.

subterminalis, *Torr.* Slow-flowing water. August.

rostellatus, *Torr.* Yates county. *Dr. Sartwell.*

cæspitosus, *L.* High mountains of Essex county. July.

debilis, *Pursh.* Sandy shores, in wet places. July.

lacustris, *L.* *Bulrush.* In fresh water. June.

maritimus, *L.* Salt marshes. Near New-York, and on Long Island.

Var. fluviatilis, *Torr.* Swamps and borders of lakes; western and northern counties.

triqueter, *L.* Swamps and wet meadows, both salt and fresh.

mucronatus, *Vahl.?* Swamp near West Point. *Prof. Bailey.*

atrovirens, *Muhl.* Wet meadows and swamps. June.

brunneus, *Muhl.* Swamps. August.

eriophorum, *Michx.* Borders of swamps, and wet meadows.

lineatus, *Michx.* Near Poughkeepsie. *Mr. Dudgeon.* This species has not been found in the State by any other botanist.

ERIOPHORUM, *L.* *Cotton Grass.*

alpinum, *L.* Sphagnous swamps; northern and western counties. May–June.

vaginatum, *L.* Deep sphagnous swamps; northern and western counties. Also on the high mountains of Essex.

virginicum, *L.* Swamps. July.

polystachyum, *L.* Boggy meadows. June.

angustifolium, *Reichard.* Sphagnous swamps; northern and western counties. *Dr. Gray.* June.

Var. brevifolium, *Torr.* Near Utica. *Dr. Gray.*

FIMBRISTYLIS, *Vahl.*

spadicea, *Vahl.* Wet meadows, particularly near salt water. Island of New-York.

ISOLEPIS, *R. Brown.*

subsquarrosa, *Schrad.* Scirpus subsquarrosus, *Muhl.* Sandy shores of lakes and rivers; northern and western counties. August.

capillaris, *Rœm. & Schult.* Scirpus capillaris, *L.* Sandy fields. July.

TRICHELOSTYLIS, *Lestib.*

mucronulata, *Torr.* Scirpus mucronulatus, *Michx.* S. autumnalis, *Pursh.* Moist sandy soils; rarely in dry places. July–September.

RHYNCHOSPORA, *Vahl.*

alba, *Vahl.* Swamps. July.

capillacea, *Torr.* Swamps, Yates county, *Dr. Sartwell.* On limestone rocks, Jefferson county, *Dr. Gray.*

fusca, *Rœm. & Schult.* Genesee county, *Dr. Bradley.*

gracilenta, *Gray.* Putnam county, *Dr. Barratt.*

glomerata, *Vahl.* Low moist grounds. July–August.

cephalantha, *Gray.* Sandy swamps. Long Island.

CLADIUM, *Browne.*

mariscoides, *Torr.* Schœnus mariscoides, *Muhl.* Wet meadows. July.

SCLERIA, *Bergius.*

reticularis, *Michx.* Sandy swamps, Long Island. August.

SCLERIA, (continued.)

laxa, *Torr.* S. reticularis, *Muhl.;* not of *Michx.* With the preceding.
triglomerata, *Michx.* Wet thickets and borders of swamps. July.
verticillata, *Muhl.* Swamps, Yates county. *Dr. Sartwell.*
pauciflora, *Muhl.* Greece, Monroe county. *Dr. Bradley.*

CAREX, *L.* *Sedge.*

dioica, *L.?* Swamps, Yates county. *Dr. Sartwell.*
exilis, *Dewey.* Sphagnous swamps, Oneida county. *Dr. Kneiskern.*
chordorrhiza, *Ehrh.* Northern and western counties. June.
disperma, *Dew.* Swamps; often on mountains.
rosea, *Schk.* Woods and low grounds. May.
Var. retroflexa, *Torr. & Gr.* C. retroflexa, *Muhl.* Wet places. May.
cephalophora, *Muhl.* Dry woods and hill sides. April.
sparganioides, *Muhl.* Low grounds and thickets. May.
stipata, *Muhl.* Wet meadows. April.
bromoides, *Schk.* Moist woods and wet meadows. May.
vulpinoidea, *Michx.* C. multiflora, *Muhl.* Swamps and low grounds. May.
decomposita, *Dew.* Yates county. *Dr. Sartwell.*
paniculata, var. teretiuscula, *Wahl.* Swamps. May.
Muhlenbergii, *Schk.* Rocky woods. May.
bromoides, *Schk.* Swamps. May.
trisperma, *Dew.* Shady swamps, and mountain woods. June.
Deweyana, *Schw.* Moist woods. June.
tenuiflora, *Wahl.* Swamps. Near Ogdensburgh, *Dr. Crawe.* Oriskany swamp, Oneida county, *Dr. Kneiskern.*
stellulata, *Good.* C. scirpoides, *Schk.* C. sterilis, *Willd.* Swamps and wet meadows. May.
curta, *Good.* C. Richardi, *Michx.* Swamps.
scoparia, *Schk.* Wet meadows. May.
Var. lagopodioides. C. lagopodioides, *Willd.* Wet meadows.
festucacea, *Schk.* Moist woods and meadows. May.
cristata, *Schw.* Swamps and wet meadows. May.
straminea, *Willd.* Swamps. May.
Var. minor. C. tenera, *Dew.* Swamps. May.
aurea, *Nutt.* Wet borders of streams, and in swamps. June.
saxatilis, *L.* Summit of Mount Marcy, Essex county. August.

CAREX, (continued.)

cespitosa, *L.? Schk.* Swamps; northern and western counties.

acuta, *L.? Schk.* Bog meadows. May.

aquatilis, *Wahl.* Wet borders of lakes, western counties. *Dr. Gray.*

crinita, *Lam.* Swamps, and along streams. May–June.

leucoglochin, *Ehrh.* C. pauciflora, *Willd.* Sphagnous swamps; northern and western counties.

polytrichoides, *Muhl.* Moist woods and low grounds. May.

Willdenovii, *Schk.* Jefferson county, *Dr. Gray.* Yates county, *Dr. Sartwell.* Moist shady places. June.

pedunculata, *Muhl.* Woods and hill sides. April–May.

squarrosa, *L.* Low wet grounds. May.

Buxbaumii, *Wahl.* Swamps; northern and western counties. June.

triceps, *Michx.* C. hirsuta, *Willd.* Meadows and open moist woods. May–June.

virescens, *Muhl.* Woods and shady hill sides. May–June.

gracillima, *Schw.* Woods and wet meadows. May.

formosa, *Dew.* Wet meadows. May.

Davisii, *Torr. & Schw.* C. Torreyana, *Dew.* Moist banks of rivers; western counties. May.

lanuginosa, *Michx.* C. pellita, *Muhl.* Wet meadows and swamps. May.

vestita, *Willd.* Wet grounds. May–June.

pennsylvanica, *Lam.* C. marginata, *Muhl.* Dry woods. April.

Var. Muhlenbergii, *Gray.* C. varia, *Muhl.* With the preceding.

novæ-angliæ, *Schw.* Mount Marcy, Essex county. June.

pubescens, *Muhl.* Woods and rocky hill sides. May.

striata, *Michx.* C. polymorpha, *Muhl.* C. Halseyana, *Dew.* Swamps; western counties. June.

oligocarpa, *Schk.* C. Sartwelliana, *Gay.* Western counties. *Dr. Sartwell.*

Var. major. C. Hitchcockiana, *Dew.* With the preceding.

laxiflora, *Muhl.* Wet meadows. May.

conoidea, *Schk.* Moist woods, in fertile soil. April–May.

tetanica, *Schk.* Wet meadows. May.

eburnea, *Boott.* C. alba, *Dewey* and American botanists; not of *Hænke.* Limestone hills, northern and western counties. June.

CAREX, (continued.)

anceps, *Muhl.* C. striatula, *Michx.* C. plantaginea & conoidea, *Muhl.* Woods and low grounds. April–May.

plantaginea, *Lam.* Shady ravines. April.

Careyana, *Dew.* Woods near Auburn. *Mr. Carey.*

digitalis, *Willd.* C. oligocarpa, *Schw.*, *Torr. & Dew.;* not of *Schk.* Rocky woods. May.

sylvatica, *Huds.* Borders of swamps. June.

debilis, *Michx.* C. flexuosa, *Muhl.* Wet woods. June.

livida, *Willd.* C. Grayana, *Dew.* Sphagnous swamps, Oneida county. June. *Dr. Gray* and *Dr. Kneiskern.*

œderi, *Ehrh.* C. viridula, *Michx.* Wet rocks and sandy shores. Lake Ontario, &c. June.

flava, *L.* Meadows and low grounds. May.

folliculata, *L.* C. xanthophysa, *Wahl.* Swamps. June–July.

subulata, *Mich.* Cedar swamps, Long Island. June–July.

intumescens, *Rudge.* C. folliculata, *Schk.;* not of *Linn.* Wet woods. June.

lupulina, *Muhl.* Swamps. June.

Var. polystachya, *Torr. & Schw.* Putnam county. *Dr. Barratt*

Var. pedunculata, *Gray.* Shore of Lake Erie. *Dr. Gray.*

tentaculata, *Muhl.* Low wet meadows. June.

retrorsa, *Schw.* Swamps. June.

oligosperma, *Michx.* C. Oakesiana, *Dew.* Wet borders of small lakes, Essex county. July.

bullata, *Schk.* Swamps. June.

Var.? cylindracea, *Torr. & Gr.* C. vesicaria, α and β, *Dew.* Swamps.

physocarpa, *Boott.* C. vesicaria, *Schw. & Torr.;* not of *Linn.* C. ampullacea, *Dewey.*

Schweinitzii, *Dew.*

aristata, *R. Br.* Watertown, New-York. *Dr. Crawe.*

trichocarpa, *Muhl.* Swamps. May.

lacustris, *Willd.* Borders of lakes. June.

scabrata, *Schw.* Shady swamps. May.

hystericina, *Muhl.* Wet meadows. May.

pseudo-cyperus, *L.* Swamps. May.

longirostris, *Torr.* Shady rocky places; northern counties. June.

limosa, *L.* Sphagnous swamps; northern and western counties. June.

CAREX, (continued.)

Var. irrigua, *Wahl.* C. paupercula, *Michx.* With the preceding.

flexilis, *Rudge.* C. blepharophora, *Gray.* Moist shady places. Oneida county, *Dr. Gray.* Essex county, *Dr. Kneiskern.* June.

miliacea, *Muhl.* Wet grassy banks. May.

pallescens, *L.* Wet grounds. May.

umbellata, *Schk.* Rocky hills. June.

ORDER GRAMINEÆ. THE GRASS TRIBE.

The Grasses are here arranged nearly as they are described in my Flora of the Middle and Northern States, and in Dr. Beck's Botany. A more natural arrangement of them will be adopted in my final report.

AGROSTIS, *L.* *Bent Grass.*

§ stricta, *Willd.* Sandy fields, near Oneida lake. June.

§ polymorpha, *Huds.* A. vulgaris and alba, *L.* *Red-top, Fiorin Grass, Herd's Grass.* Meadows, road sides, &c. June–August.

Michauxii, *Trin.* Trichodium laxiflorum, *Michx.* *Thin Grass.* Fields and meadows.

cryptandra, *Torr.* Near Buffalo, *Dr. Aikin.* Probably a Vilfa.

BRACHYELYTRUM, *P. de Beauv.*

aristatum, *P. de B.* Muhlenbergia aristata, *Roth.* Dilepyrum aristosum, *Michx.* Rocky hills and woods. June.

MUHLENBERGIA, *Schreb.*

mexicana, *Trin.* Agrostis mexicana, *L.* A. lateriflora, *Michx.* A. mexicana and filiformis, *Muhl.* Wet grounds. August.

sobolifera, *Trin.* Agrostis sobolifera, *Muhl.* Rocky hill sides. August.

Willdenovii, *Trin.* Agrostis tenuiflora, *Willd.* Rocky woods. July–August.

sylvatica, *Torr.* Agrostis sylvatica, *Torr. fl,* Rocky hill sides, near rivers. August.

glomerata, *Trin.* Agrostis setosa, *Muhl.* Polypogon racemosus, *Nutt.* Swamps. August–September.

MUHLENBERGIA, (continued.)

cinna, *Trin.* Cinna arundinacea, *L.* Swamps and wet shady woods. August.

diffusa, *Schreb.* Rocky hill sides and fields. August.

VILFA, *Adans.*

serotina, *Torr. in Gray's Gram. & Cyp.* Agrostis serotina, *Torr. fl.* Sandy swamps, Long Island. September.

vaginæflora, *Torr. l. c.* Agrostis virginica, *Muhl.*, not of *Linn.* Sandy soils and sterile hill sides. September–October.

longifolia, *Torr. l. c.* Agrostis longifolia, *Torr. fl.* Sandy fields, Long Island. September.

heterolepis, *Gray.* Rocks, Jefferson county. *Dr. Gray.* August–September.

ALOPECURUS, *L.* *Fox-tail Grass.*

§ pratensis, *L.* Fields and pastures. June.

geniculatus, *L.* Wet meadows. June.

Var. aristulatus, *Torr.* A. aristulatus, *Michx.* With the preceding.

PHLEUM, *L.* *Cat-tail Grass.*

§ pratense, *L.* *Timothy, Herd's Grass.* Fields. June–August.

PHALARIS, *L.* *Canary Grass.*

arundinacea, *L.* Swamps. July.

§ canariensis, *L.* Fields and pastures.

MILIUM, *L.* *Millet Grass.*

effusum, *L.* Wet woods. July. Northern and western counties.

pungens, *Torr.* Rocky hills. May.

PIPTATHERUM, *P. de Beauv.*

nigrum, *Torr.* Oryzopsis melanocarpa, *Muhl.* Rocky woods. August.

STIPA, *L.* *Feather Grass.*

avenacea, *L.* Dry woods and hill sides. June.

ORYZOPSIS, *Michx.*

asperifolia, *Michx.* *Mountain Rice.* Woody hill sides; western counties. April–May.

PANICUM, *L.* *Panic Grass.*

§ crus-galli, *L.* Fields and cultivated grounds. August–Sept.
hispidum, *Muhl.* Borders of salt marshes. August–September.
clandestinum, *L*, Woods and thickets. July–August.
  Var. penduculatum. P. pedunculatum, *Torr. fl.* Woods.
latifolium, *L.* Woods and moist thickets. June.
dichotomum, *L.* Woods and moist low grounds. A very polymorphous species, including P. nitidum, *Lam.* and of my Flora of the Northern & Middle States, as well as numerous species described in more recent works.
agrostoides, *Muhl.* Wet meadows. July–August.
depauperatum, *Muhl.* P. rectum, *Rœm. & Schult.* P. involutum, *Torr. fl.* P. strictum, *Pursh,* not of *R. Br.* Dry woods and sterile hills. May–June.
virgatum, *L.* Sandy shores. August.
verrucosum, *Muhl.* P. debile, *Ell.* Sandy swamps, Long Island.
prolificum, *Lam.* P. geniculatum, *Muhl.* Wet meadows, and also in sandy fields. September.
xanthophysum, *Gray.* Dry pine barrens; western counties. June–July. *Dr. Gray, Dr. Sartwell.*
capillare, *L.* Sandy fields and cultivated grounds; also in dry woods. August–September.

SETARIA, *P. de Beauv.*

§ viridis, *P. de B.* *Bottle Grass.* Cultivated grounds. July.
§ glauca, *P. de B.* *Fox-tail Grass.* Fields and road sides. July.

DIGITARIA, *Haller.* *Crab Grass.*

§ sanguinalis, *Scop.* *Common Crab Grass.* Cultivated grounds, &c. August–September.
glabra, *R. & S.* Sandy fields. August–September.
filiformis, *Muhl.* Sandy fields. August.

PASPALUM, *L.*

ciliatifolium, *Michx.* Sandy fields, August–September.
læve, *Michx.* Grassy banks and moist meadows. August.

CENCHRUS, *L.* *Hedgehog Grass.*

tribuloides, *L., Muhl.* C. echinatus, *Muhl.* Sandy shores of Long Island and the Island of New-York. July–August.

ARISTIDA, *L.*
dichotoma, *Michx.* Barren fields. July.
gracilis, *Ell.* Sandy fields. Long Island.

CALAMAGROSTIS, *Roth.*
canadensis, *P. de Beauv.* Wet meadows. August.
coarctata, *Torr. in Gray's Gram. & Cyp.* C. canadensis, *Nutt.* Arundo coarctata, *Torr. fl.* Wet thickets. Aug.
inexpansa, *Gray.* Swamps; northern and western counties. July.
arenaria, *Roth.* Arundo arenaria, *L.* Sandy seacoast of Long Island. August–September.

ANTHOXANTHUM, *L.* *Sweet-scented Vernal Grass.*
§ odoratum, *L.* Moist meadows and open woods. June–August.

AIRA, *L.* *Hair Grass.*
flexuosa, *L.* Dry woods and rocky hills. June.
cespitosa, *L.* A. aristulata, *Torr. fl.* Moist situations, along rivers. June.
atropurpurea, *Wahl.* Sources of the Hudson, Essex county. Aug.

TRISETUM, *Pers.*
palustre, *Torr.* Avena pennsylvanica, *L.* A. palustris, *Michx.* Wet meadows. May–July.
purpurascens, *Torr.* Avena striata, *Michx.* Northern and western counties. Wet woods and banks of rivers. June.
molle, *Trin.* Avena mollis, *Michx.* Rocky banks of rivers; northern and western counties. July.

HOLCHUS, *L.* *Soft Grass.*
§ lanatus, *L.* Wet meadows. July.

HIEROCHLOA, *Gmel.*
borealis, *R. & S.* Holchus odoratus, *L.* H. fragrans, *Ph.* *Seneca Grass.* Wet meadows. May.
alpina, *R. & S.* High mountains of Essex county. June.

URALEPIS, *Nutt.*
aristulata, *Nutt.* Sandy shores about New-York, and on the seacoast of Long Island. August.

ARUNDO, *L.* *Reed Grass.*
phragmites, *L.* Borders of ponds and swamps. August.

Danthonia, *D. C.*
spicata, *P. de Beauv.* Woods and fields. June–August.

Festuca, *L.* *Fescue Grass.*
§ duriuscula, *L.* Sandy fields. June.
tenella, *Willd.* Sandy fields and dry banks. June.
§ elatior, *L.* Wet meadows. June.
§ pratensis, *Huds.* Fields and meadows. June.
nutans, *Willd.* Woods and rocky shady places. June.
fascicularis, *Lam.* Borders of salt marshes, Long Island. August.

Glyceria, *R. Br.* *Manna Grass.*
fluitans, *R. Br.* Stagnant waters and ponds. June.
acutiflora, *Torr.* Wet meadows. June.

Poa, *L.* *Meadow Grass.*
§ annua, *L.* Fields and cultivated grounds. April–August.
dentata, *Torr.* Swamps. June–July.
aquatica, *L.* Wet meadows. July–August.
§ pratensis, *L.* Meadows, road sides, &c. May–July.
§ trivialis, *L.* Wet meadows. June–July.
compressa, *L.* *Blue Grass.* Fields, woods, and sandy shores. June.
serotina, *Ehrh.* *Red-top.* Wet meadows. June–July.
nemoralis, *L.* Woods and meadows. June–July.
nervata, *Willd.* Wet meadows. June.
Torreyana, *Spreng.* P. elongata, *Torr.*, not of *Willd.* Wet meadows. July.
canadensis, *Torr.* Briza canadensis, *Michx.* Swamps. July.
capillaris, *L.* Sandy fields and dry hills. August.
hirsuta, *Michx.* Sandy fields, Long Island. August.
alpina, *L.* Summit of Mount Marcy, Essex county.
pilosa, *L.* P. pectinacea, *Michx.* Sandy fields. July–August.
reptans, *Michx.* Wet sandy shores, north and west of Albany.
§ eragrostis, *L.* Sandy fields. July.September.

Obs. An undetermined species, probably new, occurs in woods, in the northern and western counties. It will be fully described in my final report.

Uniola, *L.* *Spike Grass.*
gracilis, *Michx.* Sandy swamps, Long Island. August.
spicata, *L.* Salt marshes. August–September.

TRICUSPIS, *P. de Beauv.*
seslerioides, *Torr.* Poa seslerioides, *Michx.* Sandy fields. Aug.

DACTYLIS, *L.* *Orchard Grass.*
§ glomerata, *L.* Fields and meadows. June.

KŒLERIA, *Pers.*
pennsylvanica, *D. C.* Rocky woods. May–June.
truncata, *Torr.* Dry woods. June.

BROMUS, *L.* *Brome Grass.*
§ secalinus, *L.* *Chess,* or *Cheat.* Cultivated grounds. June.
ciliatus, *L.* Dry woods. June.
purgans, *L.* B. canadensis, *Michx.* Woods and river banks. June–July.
§? sterilis, *L.* Penn-Yan, Yates county. *Dr. Sartwell.*

ATHEROPOGON, *Muhl.*
apludoides, *Muhl.* Rocky hills, Dutchess and Orange counties. August.

ELEUSINE, *Gært.* *Dog's-tail Grass.*
§ indica, *Lam.* Cultivated grounds, pavements of streets, &c. July–November.

SECALE, *L.* *Rye.*
§ cereale, *L.* Old fields. June.

ELYMUS, *L.* *Lyme Grass, Wild Rye.*
virginicus, *L.* River banks. July–August.
canadensis, *L.* River banks and rocky hill sides. July.
striatus, *Willd.* Dry rocky hills. July.
hystrix, *L.* Rocky woods. July.

TRITICUM, *L.* *Wheat.*
§ repens, *L.* *Couch Grass.* Fields and cultivated grounds. July.

LOLIUM, *L.* *Darnel.*
§ perenne, *L.* Meadows and pastures. June.

ANDROPOGON, *L.* *Beard Grass.*
scoparius, *Michx.* Dry hills and barren fields. August.
virginicus, *L.* Exsiccated swamps. September.
macrourus, *Michx.* Brackish swamps. September–October.

ANDROPOGON, (continued.)
furcatus, *Muhl.* Rocky banks. September–October.
nutans, *L.* Sandy fields and rocky hills. September.

LEERSIA, *Swartz.* *White Grass.*
virginica, *Willd.* Wet woods and thickets. August.
oryzoides, *Swartz.* Ditches and swamps. August–September.

ZIZANIA, *L.* *Wild Rice, Water Oats.*
aquatica, *Lamb.* *Tuscarora Rice.* Fresh or brackish water. Aug.

OBS. Z. fluitans, *Michx.* according to the herbarium of that botanist, was not found in Lake Champlain, as stated by mistake in the *Flora Boreali-Americana*, but near Charleston, South-Carolina.

CLASS IV. ACROGENS.

ORDER EQUISETACEÆ. THE HORSE-TAIL TRIBE.

EQUISETUM, *L.* *Horse-tail.*
limosum, *L.* Swamps and borders of ponds. June.
sylvaticum, *L.* Moist woods.
hyemale, *L.* *Scouring Rush.* Swamps and wet banks. May–June.
variegatum, *Scleich.* Wet sandy places, among rocks. Niagara, *Dr. Kinnicutt.*
arvense, *L.* Low grounds. April.
scirpoides, *Michx.* Shady rocky places; northern counties.

ORDER FILICES. THE FERN TRIBE.

SUB-ORDER POLYPODIEÆ.

POLYPODIUM, *L.* *Polypody.*
vulgare, *L.* Rocky woods and hill sides. July.
hexagonopterum, *Michx.* Moist woods. July.
phegopteris, *L.* P. connectile, *Michx.* Shady woods. July.
calcareum, *Smith.* Moist shady woods; northern and western counties. July.

ASPIDIUM, *Swartz.* *Shield Fern.*
acrostichoides, *Willd.* Shady rocky hill sides. June–August.
Var. incisum, *Gray.* A. Schweinitzii, *Beck.* Shady ravines, near Hamilton College. *Dr. Gray.*

ASPIDIUM, (continued.)
thelypteris, *Sw.* A. noveboracense, *Willd.*
Goldianum, *Hook.* Shady woods. July.
marginale, *Sw.* Rocky hill sides. July.
dilatatum, *Sw.* A. intermedium, *Willd.* Shady woods. July.
asplenoides, *Sw.* Nephrodium filix-fœminea and asplenoides, *Michx.* Shady woods. July.
lancastriense, *Sw.* A. cristatum of American botanists, not of *Swartz.* Swamps. July.

CYSTOPTERIS, *Bernh.*
fragilis, *Bernh.* Cyathea fragilis, *Sm.* Aspidium tenue, *Sw.* A. atomarium, *Willd.* Nephrodium tenue, *Michx.* Moist rocks. June-July.
bulbifera, *Bernh.* Aspidium bulbiferum, *Willd.* Nephrodium bulbiferum, *Michx.* Shady rocky places. July.

DICKSONIA, *L'Herit.*
pilosiuscula, *Willd.* Nephrodium punctilobulum, *Michx.* Shady rocky places. July.

WOODSIA, *R. Br.*
obtusa. W. Perriniana, *Hook. & Grev.* Aspidium obtusum, *Sw.* Rocky woods. July.
ilvensis, *R. Br.?* Nephrodium rufidulum, *Michx.* Sides of rocky hills. June.

ASPLENIUM, *L.* *Spleenwort.*
rhizophyllum, *L.* Camptosorus rhizophyllus, *Presl.* Moist rocks; generally on limestone. July.
angustifolium, *Michx.* Shady woods. July.
ebeneum, *Willd.* Rocky woods. July.
trichomanes, *L.* A. melanocaulon, *Willd.* Shady rocks. July.
thelypterioides, *Michx.* Diplazium thelypterioides, *Presl.* Shady rocky woods. July.
ruta-muraria, *L.* *Wall-rue Spleenwort.* Shady limestone rocks. July.

WOODWARDIA, *Smith.*
angustifolia, *Smith.* W. onocleoides, *Willd.* Swamps: rare. August.
virginica, *Sw.* Doodia virginica, *Presl.* Swamps. July.

SCOLOPENDRIUM, *Smith.* *Hart's-tongue.*
officinarum, *Sw.* Sides of limestone rocks, near Chittenango Falls. July.

PTERIS, *L.* *Brake.*
aquilina, *L.* *Common Brake,* or *Bracken.* Woods and thickets. July–August.
atropurpurea, *L.* Limestone rocks. June–July.

CRYPTOGRAMMA, *R. Br.*
gracile. Pteris gracilis, *Michx.* Allosorus gracilis, *Presl.* Rocks. Near Whitehall, *Dr. Beck.* Yates county, *Dr. Sartwell.* Northern counties. July–August.

ADIANTUM, *L.* *Maidenhair.*
pedatum, *L.* Shady woods. July.

STRUTHIOPTERIS, *Willd.*
germanica, *Willd.* S. pennsylvanica, *Willd.* Borders of swamps. July–August.

ONOCLEA, *L.*
sensibilis, *L.* Ragiopteris onocleoides, *Presl.* Moist woods and thickets. July.
obtusilobata, *Schk.?* Ragiopteris obtusiloba, *Presl.?* Near Salem, Washington county. *Dr. I. Smith.*

SUB-ORDER OSMUNDEÆ.

OSMUNDA, *L.* *Flowering Fern.*
Claytoniana, *L.* O. interrupta, *Michx.* Low moist grounds. June–July.
cinnamomea, *L.* Low grounds. July.
Var. frondosa, *Torr. & Gray.* Frond leafy below; fructiferous at the summit. O. Claytoniana, *Beck.*
regalis, *L.* O. spectabilis, *Willd.* Wet meadows and thickets. July.

LYGODIUM, *Swartz.* *Climbing Fern.*
palmatum, *Sw.* Western part of the State; locality not recorded.

SUB-ORDER OPHIOGLOSSEÆ.

OPHIOGLOSSUM, *L.* *Adder's-tongue.*
vulgatum, *L.* Low grounds and thickets. June.

BOTRYCHIUM, *Swartz.* *Moonwort.*
fumarioides, *Sw.* Moist woods. July–August.
dissectum, *Muhl.* Moist woods. August–September.
virginicum, *Sw.* B. gracile, *Michx.* Woods and rocky hills. May–June.
simplex, *Hitchcock.* Highlands of New-York. *Dr. Barratt.*

ORDER LYCOPODIACEÆ. THE CLUB-MOSS TRIBE.

LYCOPODIUM, *L.* *Club Moss.*
clavatum, *L.* Dry woods. July.
complanatum, *L.* Dry woods. July.
obscurum, *L.* L. dendroideum, *Michx.* Shady woods. July.
annotinum, *L.* Sandy woods and hill sides. July.
inundatum, *L.* Wet places; western counties. July.
rupestre, *L.* Dry rocks. July.
selago, *L.* Summit of Mount Marcy. July. Whiteface Mountain. *Prof. Hall* and *Dr. Emmons.*
lucidulum, *Michx.* Shady woods and swamps. July–August.
apodum, *L.* L. albidulum, *Michx.* Moist woods. July–August.

ISŒTES, *L.* *Quillwort.*
lacustris, *L.* Bottom of Oswego River, near the Falls. *Pursh.*

ORDER SALVINIEÆ.

SALVINIA, *Guett.*
natans, *Hoff.* Lakes of still water; western part of the State. *Pursh.*

AZOLLA, *Lam.*
caroliniana, *Lam.* Ponds and lakes; near New-York. Braddock's Bay, Lake Ontario, *Dr. Bradley.*

THIRD ANNUAL REPORT

Of T. A. Conrad, on the Palæontological Department of the Survey.

The superstructure of modern geology is based chiefly on organic remains, and it must be a narrow and partial view of the subject, which would not assign to their investigation a prominent place in a geological exploration, thus guarding against visionary hopes of treasure and erroneous conclusions which would otherwise meet the geologist at every step. Fossils, indeed, in their relations to geology, may be compared to the balance wheel of an engine, which gives regularity and certainty to its motion, and they harmonize with, and shed light on the other departments of the science. The most enlightened geologists of Europe will bear me witness that I do not give undue importance to this fascinating study. They have almost unanimously made mineral character in identifying formations, subordinate to the more intelligible record of organic remains in whole series of rocks above the primordial system, and every day's observation tends to confirm the singular agreement in the fossil contents of equivalent strata in every region of the globe, however diversified may be the mineral composition of the rocks. Thus, we are taught that the living beings of a certain era, were generally spread throughout the extended ocean, which pervaded the greater portion of the globe; the uniformity of the groups being greatest in proportion to the antiquity of the rocks which now hold their remains. Thus the identity of several ancient formations in Europe and America is clearly determined, and the mineral treasures are found to correspond in a remarkable manner, showing that the same general causes influenced the deposition of the rocks over a vastly extended area, thus giving to geological science a more tangible character, and a firmer base than its most ardent admirers would a few years since have dared to hope it would so speedily acquire.

The science of Palæontology is, therefore, not only ardently pursued in Europe by the highest order of minds, but their labors are deemed worthy to be encouraged by the proceeds of certain funds for the advancement of scientific knowledge, but the legislature of New-York alone has had the liberality to cause the organic remains of the various formations to be figured and described in the final report of the geologists. The plan contemplated in describing them, is that of a stratagraphical arrangement, or grouping of all the organic remains a particular series of strata referrible to one geological epoch; and that a student may with the book before him in the field identify at once the rocks he desires to investigate. And so admirably distinct are the grand divisions of the rocks, not in mineral character, but in the fossil groups they contain, that with the clew we shall furnish, no one can easily mistake either of the formations within the limits of the State. To obtain such desirable results, much time and labor is necessarily required in a new and unexplored field. The obscurities of the ancient records of creation are often "perplexing in the extreme," and the naturalist must patiently and minutely trace those slight characters and delicate distinctions which mark a species; make close comparisons with the analogous fossils of distant lands of which the geology is better known, and having thus a clew to the comparative ages of his various formations, he speaks with confidence on the probable occurrence, or the certain absence of coal and some valuable metals, and by a good description and accurate figures of fossil remains, enables every one who takes an interest in the subject speedily to acquire the important knowledge which has been slowly and laboriously gained.

The occurrence of several formations of great thickness between the primary and coal series was unknown in this country before the publication of the first annual reports of this survey. The splendid work of Murchison on the Silurian system, has given intense interest to their investigation, as they nearly all belong to this system, to which I referred them in my first annual report as geologist of the third district, deriving my information from a tabular list of organic remains, published by Murchison in a scientific journal. The appearance of his great work marks a distinct era in geological inquiry, inasmuch as it affords a standard of comparison for a series of the least known and yet most important and universally extended formations of the globe, the same species of shells and corals being found in these rocks in Asia, Europe, Africa and America, and in all latitudes. The series in New-York is far more complete than that of Wales described by Murchison; the formations pre-eminently characterized by their organic contents being three times the number of those illustrated in the "Silurian system."

Caradoc sandstone.

The organic contents of the Caradoc sandstone and Trenton limestone correspond as groups, and the Llandeilo flags are absent. The fossils common to the two groups are embraced in the following list:

Trilobites.

Cryptolithus tessellatus, *Green*, (Trinucleus carractaci, *Murch.*) Calymene punctata, *Wahl.*

Shells.

Strophomena sericea, (Leptæna, *Sow.*) Strophomena alternata, (Orthis, *Sow.*) S. compressa, (Orthis, *Sow.*) Orthis callactis, O. flabellulum, O. testudinaria, Delthyris tripartita? (Terebratula, *Sow.*) Lingula attenuata, Trochus lenticularis, Euomphalus corndensis, (Louisville, Kentucky,) Bellerophon bilobatus, (abundant at Trenton Falls.)

Thus we have thirteen species in the Trenton limestone, which are characteristic of the Caradoc sandstone; thus identifying the formations notwithstanding the great difference in mineral composition.

Salmon river sandstones and shales. By this name I have indicated a formation which over-lies and immediately succeeds the Trenton limestone series, and was the first to shew that it possessed a distinct group of fossil very different from those above or below it. I find not one of these species noticed in Murchison's work, and therefore the formation is probably wanting in Wales.

Niagara sandstone. This name I applied to the red sandstone of Niagara and Oswego, and ascertained that its fossil remains are peculiar to it; the splendid Fucoides Harlani characterising it in New-York, Pennsylvania and Virginia. Though this fossil has not been found in Wales, yet a shell which is peculiar to the Niagara sandstone, Bellerophon trilobatus, (Sowerby,) occurs in the Caradoc sandstone, and in the strata above it we find Tentaculites annulatus, Agnostus latus, (A. pisiformis, *Murch.* pl. 3, fig. 17,) and particularly the Pentamerus oblongus, and P. lævis which characterize the upper part of the Caradoc sandstone in Wales. Therefore, I presume that from the limestone containing the Pentamerus to the base of the Trenton series, all the rocks would be included in the Caradoc formation, according to Murchison's arrangement, but they should evidently be classed in four distinct formations.

Wenlock shale.

This is identical with the shales at Rochester, which abound in the Asaphus limulurus of Green, (A. longicadautus, *Murch.*) The fossil common to both sides the Atlantic are as follows:

Trilobites.

Bumastus barriensis, found by Mr. Hall, Asaphus limulurus.

Shells.

Strophomena transversalis, (Leptæna, *Sow.*) Orthis elegantula, (O. canalis, *Sow.*) O. hybrida, O. sinuatus, (*Sow.*) Orthoceras annulatum.

Wenlock limestone.

Mr. Murchison supposes the Wenlock limestone immediately succeeds to the shale as it doubtless does in Wales, but the two formations are here separated by the following rocks; each of considerable thickness, and with distinct fossil groups: 1. Lockport limestone; 2 Gypseous shales; 3. Water lime series. Over the latter we find a blue sub-crystalline limestone, and then a gray shaly limestone, which together appear to represent the Wenlock formation, both in fossils and mineral character. The comparative list is as follows:

Trilobite.

* Calymene bufo, *Green*, (C. macropthalma, *Murch.*)

Shells.

Strophomena euglypha, (Leptæna, *Sow.*) S. rugosa, (Leptæna depressa, *Sow.*) Atrypa prisca, (A. affini, *Sow.*) A. lacunosa, (Terebratula, *Sow.*) Pentamerus galeatus, (Atrypa, *Dal.*) Atrypa bidentata, (Terebratula, *Sow.*) Conularia quadrisulcata, †Tentaculites ornatus.

CORALS.

Aulopora serpens, Millepora repens, Favosites gothlandica, F. fibrosa. The Cyathophyllum dianthus, C. turbinatum, Syringipora bifurcata? are found only in the limestones above the shaly limestone, and separated from it by five formations. 1. A blue limestone well marked by the remains of a large species of Crinoida resembling a Scutella in form. 2. Oriskany sandstone, with a most singular group of large brachiopodous bivalves, of which not one is figured by Murchison. 3. Fucoidal brown sandstone. 4. Grit, which is the Lower Ludlow rock of Murchison. 5. Black limestone.

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* This occurs more abundantly in the Ludlow equivalents.

† This shell is found only in the water lime series under the Pentamerus galeatus.

Lower Ludlow Rock

The position of this I have indicated above, but there are other formations higher in the scale which have different fossils, yet evidently analogous to those of the Lower Ludlow rocks. The comparative list in the grit is as follows :

Shells.

Phragmoceras arcuatum, Lituites biddulphii, Orthoceras pyriforme, Spirorbis tenuis.

The Lituites biddulphii has the spirorbis impressions upon it just like the specimen figured by Murchison.

One of the finest geological sections in the whole range of the Silurian system occurs at Schoharie, where fortunately the organic remains have been collected in great numbers by my friend John Gebhard, Jun. whose zeal is worthy of all praise. Through him I have obtained rare and valuable specimens for the use of the survey, and still more valuable information regarding the stratagraphical position of some of them. It may be interesting to some persons to have a knowledge of this section, and I therefore subjoin it, and embrace some of the fossils of the Helderberg in the same table.

Black slate, ...	Posidonia, Orthoceras linteum.
Gray limestone, ...	Odontocephalus selenurus, (Asaphus, *Eaton*,) Platyceras dumosum, Delthyris acuminata.
Blue limestone, ...	Favosites gothlandica, Cyathophyllum vermiculare, Syringipora bifurcata?
Black limestone, ...	Calymene Rowi, Asaphus laticostatus, Atrypa naviculoides.
Grit, ...	Calymene platys, Lituites biddulphii, Phragmoceras arcuatum, Orthoceras pyriforme, spirorbis tenuis, Pleurorhyncus cuneus.
Brown sandstone, ...	Fucoides cauda-galli.
Oriskany sandstone, .	Atrypa elongata, Delthyris arenosa, Strophomena unguiformis.

Blue limestone,	Delthyris, (new species,) new forms of Crinoidea.	
Gray shaly limestone	Asaphus pleuroptyx, Delthyris macropleura, Strophomena costellata, S. rugosa, Atrypa prisca, Conularia quadrisulcata, Calceola, (new.)	
Blue limestone,	Pentamerus galeatus, Atrypa lacunosa.	
Shale,	Astrocrinites,	Water lime series.
Black limestone,	Asaphus micrurus,	
Shale,	Cytherina alta, Tentaculites ornatus,	
*Shale,	No organic remains,	
Shale	Favosites gothlandica,	
Graywacke,	No organic remains.	

Each of these formations is marked by a wide terrace suggesting the idea of a stair case on a large scale. This adds much to the picturesque beauty of the scenery at Schoharie, when viewed from a distant point.

Descriptions of new species of organic remains.

TRILOBITES.

Odontocephalus selenurus.

In Mr. Gebhard's collection I was fortunate enough to discover the thoracic plate of this trilobite, and a whole specimen from Auburn has proved that the tail of Asaphus selenurus, and the head of Calymene odontocephalus belong to the same trilobite. The thoracic plate has teeth-like angular projections which interlock with another set on the front margin of the buckler, which I have deemed a generic character in conjunction with the peculiar form of the ribs and the still more singular shape of the tail which has two long spines. Mr. Gebhard had drawn the inference that the two nominal species were identical in consequence of their frequent occurrence together in the rock. This trilobite characterizes a limestone above the grit which contains the Lower Ludlow fossils.

Asaphus Hallii.

I have given Mr. Hall's name to a species of Asaphus found by that geologist, at York, Livingston county. The lower part of the abdomen and tail are well preserved, but there is no line of division between the two. No portion of the original crust remains. It may thus be characterized; ribs numerous, narrow, prominent, with a longitudinal groove tuberculated on the margins; ribs of the middle lobe somewhat angulated in the middle, the angle pointing downwards; margin of the tail regularly rounded, with a broad flat depression between it and the ribs, finely striated. A buckler was found in the same locality, which is probably of this species. It has a general resemblance to the buckler of A. longicaudatus of Murchison, but the oculiferous tubercles are far larger.

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* Mr. Gebhard found his fine specimen of strontian and barytes in this shale.

Acidapsis tuberculatus.

A very small species much like a Limulus, especially in the tail which is a long spine; the angles of the buckler are elongated; the whole surface of the buckler covered with unequal pustules ; on each side of the middle lobe are two short elliptical tubercles. It is very dissimilar to the species described by Murchison, and much smaller. I found one specimen in the shaly limestone or Wenlock equivalent, near Clarksville, Albany county, in the bank of a stream.

Acanthaloma.

This is a fragment apparently of the buckler of a most singular species; it is elongated into a curved spine and has a row of spines along the front, and three spines on the opposite side of the prolongation. not uncommon in the shaly limestone near Clarksville.

UNIVALVE SHELLS.

Platyceras.

I propose to group in this genus the Pileopsis tubifer, *Sowerby*, P. vetusta, *Sowerby*, the Nerita haleotes, *Sowerby*, and perhaps Bellerophon cornu-arietis. The shells are suboval or subglobose, with a small spire, the whorls of which are sometimes free and sometimes contiguous; the mouth is generally campanulate or expanded. I have seen a species above the Silurian rocks, though they probably occur above them in Europe, and they are never found in the Lower Silurian strata, They characterize the middle portion of the system.

Platyceras dumosum.

Shell covered with thick tubular spines arranged in longitudinal rows; margin of aperture waved ; volutions free.

Localities. Near Clarksville, Albany county, and at Schoharie, in the limestone which contains the Asaphus selenurus of Eaton. It also occurs in the Moscow shales in Livingston county. In some varieties the spines are comparatively few.

Platyceras ventricosum.

Shell ventricose; aperture very large and campanulate; volutions three, contiguous, depressed below the upper margin of the large whorl.

Locality. Near Clarksville. Occurs abundantly in the shaly limestone or Wenlock equivalent.

Platyceras Gebhardii.

Differs from the last, in having a much larger and more prominent spire which is longitudinally carinated near the apex and with distinct transverse undulated striæ. Found at Schoharie by John Gebhard, Jr. in the same limestone which contains the preceding species.

CYRTOCERAS.

Cyrtoceras trivolvis.

Shell large, rounded; with transverse waved lines of growth; septa numerous.

Locality. Schoharie; Mr. Gebhard.

Cyrtoceras Matheri.

Resembles the last, but the transverse ridges are more prominent and distant, they meet at an angle on the middle of the back.

Locality. Found with the preceding, by Mr. Gebhard.

Phragmoceras spinosum.

Shell with two rows of foliated spines.

Locality. Schoharie; Mr. Gebhard. Occurs in the grit which con tains the Lower Ludlow species.

BIVALVES.

Pleurorhyncus cuneus.

Shell triangular, with radiating ribs; umbonial slope oblique, anterior side cuneiform, rostrated; anterior dorsal margin straight, oblique, thick; sub-margin broad and separated from the disk by a deep groove.

Localities. Near Salem, Albany county, and at Schoharie. They most abound in the grit above mentioned, but also occur in a black limestone above, and more rarely in the gray limestone over the latter. This is the fossil well known as the bilobite, which is a crushed specimen.

Calceola plicata.

Shell longitudinally striated; plicated towards the aperture, the margin of which is waved.

Locality. Schoharie; Mr. Gebhard. Occurs in the shaly limestone.

Delthyris macropleura.

Shell large, with about six broad rounded ribs finely striated longitudinally; middle of the superior valve with a very broad and prominent rib, and there is a corresponding depression on the opposite valve.

Localities. Near Clarksville and Schoharie In shaly limestone, abundant.

CRINOIDEA.

* *Lepocrinites Gebhardii.*

By this name I introduce a singular fossil found by Mr. Gebhard. The body is composed of plates of unequal sizes, a few of which have ambulacra, connecting this fossil with the echinodermata; lower half of the column apparently solid and traversed by a pentangular canal.

T. A. CONRAD, *Palæontologist.*

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* For geological position, see table of Schoharie fossils.

LETTER

From W. W. Mather, transmitting his Fourth Annual Report.

Brooklyn, Con. Dec. 27, 1839.

To his Excellency William H. Seward.

My dear Sir :

I enclose herewith the Fourth Annual Report on the Geological Survey of the First District of the State.

It contains the results of my observations on the economical geology of Sullivan, Ulster, Delaware, Greene and Schoharie counties. Many important facts have been observed, that were before unknown. The discovery of fine building stones and marbles, favorably situated for exploration and transportation : the tracing the stratum of flagging stone rock to a great distance, a material that was supposed to be confined to a small area ; a similar fact in regard to the water limestone of Ulster county, and which is ascertained to be inexhaustible ; the discovery of extensive bodies of peat, a combustible second only in value and usefulness to coal beds : the notice and discovery of mineral springs ; and the examination of supposed mines, the proprietors of which have been discouraged from the further expenditure of capital, where there were not indications to warrant exploration ; are among the useful results of the survey during the past season.

I have the honor to remain,

Very truly, your ob't serv't,

W. W. MATHER,

Geologist First District, New-York.

FOURTH ANNUAL REPORT

Of W. W. Mather, Geologist of the First Geological District of the State of New-York.

To his Excellency WILLIAM H. SEWARD.

SIR :—

Since the last report, I have been engaged in exploring the geological phenomena of the counties of Sullivan, Delaware, Ulster, Greene and Schoharie.

Of the twenty-one counties of the First District, sixteen have now been examined, viz: Suffolk, Kings, Queens, Richmond, New-York, Westchester, Putnam, Dutchess, Columbia, Rockland, Orange, Sullivan, Ulster, Delaware, Greene and Schoharie.

I had supposed that so much of the next season would be devoted to the geological survey, as would complete four years from the dates of the several commissions, and perhaps more than this, to enable the various individuals, not only to complete their field labors, but also their final report of the survey. It is now understood that the survey will close on the first of July next. As there are five counties in the First District which are yet unexamined, they cannot be explored in the short time remaining, with the same degree of attention that has been bestowed upon the others, and which I should give to these, had I the time I had expected.

PRELIMINARY OBSERVATIONS.

The general physical features and aspect of the country, as well as the agricultural and mineral value, are dependent on its geological structure and mineral composition. There are four distinct groups of rock formations in the region examined the past season, each of which demands consideration in an economical point of view, and which also presents many points of the highest interest to science.

The subjoined nomenclature of these rock groups is presented as local, and one of convenience merely, as the divisions are thus easily traced. Although there is scarcely a doubt as to what formations in Europe these are equivalent, yet, I have thought it preferable to describe groups of rocks as they are, instead of striving to identify them with those of other countries, which must necessarily differ from them in some respects. Geological equivalents can be settled in a permanent manner, when all the facts of superposition, and the more or less local extent of subordinate strata, shall have been definitively ascertained.

B. FOSSILIFEROUS SERIES OF ROCKS.

(1.) The lowest in the series is the *Hudson River Slate group*, consisting of slates, shales, and grits, with interstratified limestones, all of which occur under various modifications. This group is overlaid unconformably in many places by the various rock formations of more recent origin.

(2.) The next in order of superposition, in the district under examination the past season, is the *Shawangunk grits*, including the associated red and green slates, shales and grits.

(3.) The next in order is the *Helderberg group*, which is composed of various strata of common and hydraulic limestones of various colours and textures, (enclosing a great variety of fossil remains,) interstratified with grits and shales. It includes the limestones of the Helderberg, of Schoharie, Saugerties, Kingston, and the valley of the Delaware and Hudson canal to Carpenter's Point, on the Delaware.

(4.) The *Catskill Mountain group* terminates the series of *indurated rocks* in the First District. This group consists of white, gray and red conglomerates, with gray, red, olive, and black grits, slates and shales. Some of the strata in the lower half of this group, abound with the impressions and casts of fossil shells, while those of the upper half contain the impressions and casts of numerous plants, some of which are similar to those of the coal beds of Carbondale.

The tertiary and alluvial formations complete the series of rocks under examination this season, in the First District. The groups and formations will be discussed in order, beginning with the most recent.

Economical Geology of Sullivan, Delaware, Ulster, Greene and Schoharie Counties.

The economical results of the survey, with as little of scientific detail as possible, are brought before the public in the annual reports. It has been thought proper to retain most of the strictly scientific matter, until the *final report*, to insure greater certainty in the results, from long continued, more extended, and better matured observation.

Topographical character.

The general aspect of the country where the *Hudson River group* forms the surface, is hilly, with a good soil, though often very broken and stony. The hills rarely exceed three or four hundred feet above the Hudson. The Shawangunk mountains, Marlborough mountain, Huzzy hill, and the range of high hills between the two latter, and between the Wallkill and the Hudson are from 600 to 1,100 feet high.

The *Shawangunk grits*, and the strata between these and the Helderberg and Schoharie rocks, are high rolling hills, with a cold, and frequently a stony soil.

The limestone and slate lands of the *Helderberg group* are rolling, with a good soil, and very productive for wheat and other crops. The strata are generally nearly horizontal, but through the valley of the Delaware and Hudson canal, and from Kingston to Coxsackie, the rocks are upheaved, and sometimes overturned. Many parts of this region are very rough and broken.

The *Catskill mountain group* forms the high mountain region of Greene, Ulster, Sullivan, Delaware and Schoharie counties. The streams flow in deep valleys which seem to have been formed by erosive action, since the strata in most instances correspond on the opposite sides of the valleys. There are some exceptions, where there are indications of great fractures and rents of the strata, which traverse the country for many miles, and give direction to the streams. The soils on this formation are generally good, but as the country is very heavily timbered, much time, labor and expense are required to bring them into use.

The tertiary and alluvial lands are level, or with small hills. The former are generally terraces of nearly level land, at an elevation of 10 to 150 feet above the streams in the valleys.

Alluvions.

These deposits are in constant process of formation, by a great variety of causes in action at the present time. The two most important alluvions in the counties under examination, may be classed under the names of *fluviatile* and *marsh alluvions.*

A large portion of the *low* lands along the rivers, creeks and smaller streams, which are so generally celebrated for their fertility, and which vary in texture from clay through loam and sand, to gravel and pebble beds, belong to fluviatile alluvions. The most extensive deposits of this class, in the counties under examination, are those on the Wallkill, extending from below Springtown, by that village and New-Paltz, to near Libertyville: those of the Rondout river, near Rochester, Wawarsing and Ellenville; those of the Esopus creek, from Marbletown, by Hurly and Kingston, to near the Esopus Falls; those of the Catskill and Katerskill creeks; and the Schoharie flats, which extend with slight interruptions, from the mouth of Kripplebush kill, by the villages of Central Bridge, Schoharie and Middleburgh Bridge, to 4 or 5 miles above the latter place.

The Schoharie flats have long and justly been celebrated for their exuberant fertility. The soil contains a mixture of such materials as makes sandy, gravelly and argillaceous loams, with a suitable mixture of animal, vegetable and calcareous materials. These flats are frequently overflowed by freshets, and the soil is thus renovated by fresh additions of animal, vegetable and mineral matter. The soil, in consequence of these additions, is less rapidly deteriorated by constant tillage than it would be under the common skinning and exhausting modes of cultivation, in which the produce of the land is taken off and nothing returned to it, to serve as aliment to the succeeding crops.

There is another class of fluviatile alluvions in the counties under examination, as yet unsusceptible of cultivation; but these deposits are gradually approaching a state, in which they may be expected to become productive and valuable lands. These are the mud flats, at, and near the mouths of the various streams that flow into the Hudson river; the shoals of sand, gravel and mud, in the re-enterings of the shore, and where eddy currents are formed during the flux and reflux of the tide; and where the tidal flow is checked by the current of the river. These deposits are continually increasing in extent and thickness, not only by the deposition of earthy materials, but also by the constant accumulation of vegetable and animal matter, from the successive growth and decay of various organic products.

The most extensive and important of these alluvial flats, may be classed as *deltas* on a small scale, and they extend some distance above and below the mouths of the Rondout, Esopus and Catskill creeks. The smaller flats are too numerous to mention, but the mud that has accumulated on them, and which is generally uncovered at low ebb-tides, is well adapted for use by the farmer on his soils as a manure. It is believed that this material, which is loaded with organic products, will soon be extensively used for improving the farms adjoining the Hudson river.

Marsh Alluvions.

Peat and bog iron ore are the principal marsh alluvions in the counties under examination. No beds of swamp and "lake marl," like those of Orange, Columbia and Dutchess counties have been observed the past season. The peat bogs are not very numerous. The principal ones are as follows :

	Cords.
1. The summit of the Delaware and Hudson canal, between Wurtzboro' and Red bridge, in Sullivan county, contains about	50,000
2. A marsh extending down the valley of the Basher's kill, from near Wurtzboro' towards Cuddebackville, and containing probably 1000 acres, with 1000 cords per acre,	1,000,000
3. A bog a few miles west of Ellenville, (did not see it,) say,	100,000
4. The bog in the valley of Three brooks, south of Monticello,	500,000
5. The marsh 1 mile southwest of Monticello, belonging to Hon. Mr. Jones, and others,	50,000
6. The marsh half a mile southwest of Monticello, belonging to Hon. Mr. Jones,	8,000
7. The marsh half a mile west of Monticello, belonging to Hon. Mr. Jones,	10,000
8. Several marshes between Monticello and Bridgeville, on the Neversink,	60,000
9. Bog between Dashville and Esopus, on the north end of the Passant Binnewater, say 40 acres,	40,000

		Cords.
10.	Bog 1 mile north of the above, on the north branch of the south fork of Black creek, in Paltz, Ulster county,	10,000
11.	Bogs on Black creek, near the Poughkeepsie and Paltz turnpike,	60,000
12.	Bog in the valley of the east branch of the Delaware in Roxbury, Delaware county, on Mr. Stratton's farm,	10,000
13.	Bog in Marlborough, on the south road from Marlborough to Pleasant Valley, on land of G. Birdsal, Mrs. Bingham and D. Cassman, in Ulster county,	20,000

I would again urge upon our farmers and other citizens, the importance of making use of peat for fuel and manure. It is a cheap and valuable article for fuel, and when properly prepared, it also makes one of the best renovators of the soil.

It has been recommended to burn this combustible in heaps in the field, and scatter the ashes over the ground. A great loss is thus sustained, for the earthy and saline portions only of the peat are obtained, while by far the largest portion of the mass, that part, in fact, that would afford food to plants, is consumed and dissipated in the atmosphere.

The best mode of preparing peat for manure is, to make it into compost heaps, with some lime and stable manure, or, to have cattle and hogs yarded on it, where it is exposed to the weather and frost. In order to set this matter in a proper light, and enable our farmers to profit by the experience of others, I subjoin two letters to Dr. Jackson, the State Geologist of Maine, from gentlemen who are strictly practical farmers, and who are considered among the best farmers in Massachusetts.

" *Lexington, January* 30*th*, 1839.

" DEAR SIR :

" I herewith send you a sample of my peat. I am very desirous of availing myself of the benefit to be derived from a chemical analysis of the same, which you kindly offered to make. A more intimate knowledge of the nature and properties of peat, which can be obtained only by a scientific examination of its constituent parts, would enable farmers more justly to appreciate this valuable species of land. It is from a want of this knowledge, that our extensive tracts of low meadow and swamp lands have hitherto been esteemed of little or no value. Allow me to say, sir, that I know of no way in which you could render a more essential service to the public, more especially to farmers, than by enabling them to convert their unproductive and unsightly bogs and morasses into luxuriant fields and sources of wealth. I consider my peat grounds by far the most valuable part of my farm; more valuable than my wood lots for fuel, and more than double the value of an equal number of acres of my uplands, for the purposes of cultivation.

"In addition to these, they furnish an inexhaustible supply of the most essential ingredient for the manure heap. A statement of the uses to which I have appropriated peat lands, and my management of them, though very imperfect, may serve to give you a partial conception of their value and uses, and at the same time enable you to see how important it is that the farming community should have more information on this subject.

"In the first place, they are valuable for fuel. I have for twenty years past resorted to my peat meadows for fuel. These, with the prunings from my fruit trees, and the brush from my uncleared lands, have given me my whole supply. The prunings and brush are bound in bundles and housed; and with the help of a small bundle of these faggots, and peat, a quick and durable fire is made. It gives a summer-like atmosphere, and lights a room better than a wood fire. The smoke from peat has no irritating effect upon the eyes, and does not in the slightest degree obstruct respiration, like the smoke of wood; and it has none of that drying, unpleasant effect of a coal fire. The ashes of peat are, to be sure, more abundant, but not more troublesome, and are less injurious to the furniture of a room, than the ashes of coal.

"The best peat is found in meadows, which have for many years been destitute of trees, and brush, and well drained, and where the surface has become so dry, and the accumulation of decayed vegetable matter so great, that but little grass or herbage of any description is seen upon the surface. If the meadows are suffered to remain in a wet and miry condition, the wild grasses and coarse herbage will continue to grow, and the peat be of a light and chaffy texture, filled with undecayed fibrous roots. By draining they become hard, and the peat becomes compact and solid, and the cutting out and carrying off greatly facilitated. A rod square, cut two splittings deep, each splitting of the depth of 18 inches will give three cords when dried. It may be cut from May to September. If the weather in autumn be very dry, the best time for cutting will be from the middle of August to the middle of September. If cut the latter part of summer, or early in autumn, it dries more gradually, and is not so liable to crack and crumble, as when cut early in summer. The pieces are taken out with an instrument made for the purpose, from two to three inches square ; and if of good quality, will shrink about one half in drying. It is considered a day's work for a man, a boy, and a horse to cut out and spread a rod square. The man cuts it out, and lays it upon a light kind of drag made for the purpose, and it is drawn off by the horse, and spread by the boy as thick as the pieces can lay singly. After becoming dry enough to handle without breaking, it is made into piles, cob-house fashion, of from 12 to 20 pieces in a pile. It will then require about four weeks of dry weather to render it fit to be housed for use. The top, or turf, is thrown back into the pits, from which the peat is taken ; and if well levelled, and the ground drained, it will, after the first year, give a large crop of foul meadow, or other lowland grass. Peat taken from land which has been many years drained, when dried, is nearly as heavy as oak wood, and bears about the same price in the market.

"The value of peat and swamp lands for tillage, is now pretty well known, and acknowledged. Some years since, I occasionally sold to my neighbors a few rods of my peat land, yearly, to be cut out for fuel, at three dollars per rod, being at the rate of four hundred and eighty dollars per acre ; but finding this sum to be less than its value for cultivation, especially when laid to grass, I have declined making further sales at that price. I have raised upon my reclaimed meadows seventy-five bushels of corn, five hundred bushels of potatoes, or from four to five tons of the best hay, at a first and second cutting to the acre, at a less expense of labor and manure, than would be required to produce half this crop upon uplands. To render these lands productive, they should be thoroughly drained, by digging a ditch around the margin of the meadow, so as to cut off the springs, and receive the water, that is continually flowing in from the surrounding uplands. If the meadow be wide, a ditch through the centre may be necessary, but this will be of no use without the border ditches. This being thoroughly done, and the surplus water all drawn off, the next step is to exterminate the wild grasses, and herbage of every kind, that grow upon the surface. To effect this, the method heretofore generally, and now by some pursued, is to cover with gravel or sand, top dress with manure, sow the grass seed, and then rake, or bush it over. This, for the first year or two, will give a good crop of hay ; but after this, I have invariably found that the more coarse and hardy kinds of wild grass would work their way through the sand, or gravel, and entirely supplant the cultivated grasses—when the whole must have another covering, or be adandoned as worthless. If to be planted with corn, or any of the root crops, my course has been to turn over the turf or sward with a plough having a wrought iron share or coulter, ground to a sharp edge, in the dryest season, say in the month of September, roll down as hard as possible, carry on in the winter a sufficient top dressing of compost, twenty cart loads to the acre, and in the spring plant with corn or roots without disturbing the sod. When the corn or roots are taken off, the surface is made smooth with the cultivator, or hoe and harrow, and late in November, or just before the heavy frosts set in, sow with herds grass and red top seed, half a bushel of the former and one bushel of the latter to the acre. The field is then rolled, which completes the process. If the plough does not turn the sods smooth, it will be necessary to follow it with the bog-hoe, to level the uneven places. By keeping the sod undisturbed in the cultivation, a more firm and compact surface is formed, upon which horses or oxen may work, generally, without danger of miring. If the land is intended for grass, without the intervention of a hoed crop, the turf is turned over with the plough, as before stated, in August or September, or as early as the surface becomes dry enough to admit the oxen or horses upon it ; then follow with the bog-hoe, and turn over such parts as the plough has left unturned, make the whole smooth with the hoe, and late in November spread on a dressing of compost, not less than twenty cart loads, made half of loam and half of stable manure, to the acre ; then sow the grass seed, and bush and roll down. If the ground be miry, so as to render the use of the plough impracticable, the bog-hoe must be resorted to, and the whole turned over by hand, and top dressed and seeded to grass, as above stated. The cost of turning over with the hoe will be twenty dollars per acre, at the usual price of labor. This mode of culture completely subdues the natural wild grasses, and gives a compact and rich surface of vegetable mould, which will give an abundant crop of the best English hay, for four or five years, without the aid of more manure. If the sod is disturbed, and attempted to be pulverized, in the course of the cultivation, the surface, when laid to grass, will be loose and spongy ; an extra top dressing of loam and manure will be required, and, after all, the surface will not become so compact, nor the produce by any means so great.

"Should meadows be found too soft and miry to admit of their being ploughed in the summer or autumn, and the expense of turning with the hoe should be thought to be too great, I would advise ploughing in the spring, when the frost is out to the depth of three or four inches, carting on manure, and then sowing or planting at a convenient and proper season. The art of reclaiming these low meadows, consists in taking off all the surplus water by judicious draining, and in thoroughly exterminating the natural herbage and grasses. This being effected, we have our rich bottoms equally as productive as the deep alluvials of the west, and obtained at a cost and sacrifice infinitely less.

"The third particular in which peat lands may be considered valuable to the farmer, consists in furnishing him with a very important ingredient for his compost. Peat is made up principally of decomposed vegetable substances, with a portion of the lighter particles of vegetable mould, washed in from the surrounding highlands. But when taken fresh from the pit, it contains certain antiseptic properties, injurious to vegetation, which must be absorbed or neutralized, by a combination with other substances, in order to render it food for plants. This may in some measure be effected by exposure to the action of the air and frost. Where the surrounding uplands are composed of gravel and sand, the peat or swamp mud may be called silicious, and is less valuable for manure, especially if the adjacent uplands rise abruptly: when composed principally of clay, the peat is aluminous. This is frequently found resting on beds of marl, and is considered much richer and more valuable for the compost heap.

"I have annually, for some years past, used on my farm some hundreds of loads of peat mud, which is either thrown into my hog-sty, or mixed with fresh stable dung, or with lime. When mixed with green stable manure, the proportions are two parts of peat mud to one of dung; and I am confident, from repeated experiments, that a load of this compost, well mixed and fermented, will give as great a produce, and a more permanent improvement to the soil, than the same quantity of stable manure. In this opinion I am not alone. Other accurate and intelligent cultivators have made similar experiments with similar results.

"The vegetable substances of which peat is composed, having been decomposed in stagnant waters, they have not passed through a putrefactive fermentation, and are therefore supposed to retain much of their natural oils, gums and acids. Peats, in this region are also supposed to contain portions of sulphate of iron, or copperas, oxide of iron, &c. This opinion is formed from noticing the difference between the effect produced by using the peat mud on grounds when first taken out of the meadow; and that which is produced after fermentation, with stable manure, or mixing it with lime. The ashes of peat have little or no perceptible effects when used alone, but by mixing them with lime, they become a valuable manure.

"That our peat may possess other and different properties, which are in a greater or less degree injurious to plants, is highly probable. These can be detected and remedied only by the aid of science. It is to the agricultural chemist, that the practical farmer must look for a development of his resources, to remove the obstacles which impede his progress, and to impart that information which will give confidence to action, and a successful issue to labor.

"With an earnest desire that you may persevere in your useful labors,

"I am, dear sir, with the highest respect,
"Your obedient servant,
(Signed) "E. PHINNEY."

The other letter is also subjoined.

"Dear Sir:

"Being much indebted to you for information in regard to the use of peat, as a manure, and the mode in which its acid properties may be not only neutralized but made a valuable food for plants, I beg leave to state, that in the fall of 1836, I took from my bog about three cords of peat, and placed it in a pile on the nearest solid land, in the woods. It remained there undisturbed until sometime in November, 1837. By the action of the *frost* of the preceding winter, and the heat of the summer, it had lost much of its adhesive property and was greatly reduced in weight.

"I now brought it home, and while one was unloading, another sifted in lime with the hand, (it having been previously slaked to a fine powder,) at the rate of one bushel to a cord of peat. Lime having been thus scattered evenly through the whole mass, nothing further was done to it until about the middle of the next May. Observing, after the manure had been removed from the barn yard, that a considerable quantity of water from the rains had collected itself in the lowest part of the yard (say six or eight barrels,) I had the peat removed into it. The garnet coloured wash of the yard was rapidly and entirely absorbed. I allowed it to remain in this situation until the first of June, during which time its colour had changed from mahogany to jet black. Fermentation did not take place.

" By the successive action of the frost, lime, and the wash of the yard, the sensible qualities of the peat had very much changed. When first taken from the bog, it was pulpy and very adhesive—could be spread like butter; now it was a fine powder, having entirely lost its peculiar adhesive properties.

" I used the manure thus prepared, for squashes—planting fifteen rods of ground, very sandy and much exposed to drought. After the manure had been dropped, (one shovel full in a hill,) I sprinkled a little lime in each hill, directly upon the peat. Upon this, I planted the autumnal marrow squash. The seeds came up well, and the plants were of a healthy colour. Some of the plants were destroyed, and all of them badly eaten by insects; the yellow bug was most destructive. The plants, after they had recovered from this shock, grew more rapidly than any that I had before witnessed. The colour of the vines, and the rapidity with which they covered the ground, were most convincing proofs to my mind that they were perfectly healthy, and well supplied with nutriment. In the severe drought which came on in the summer, these vines, for many weeks, did not appear to suffer, while others of a similar kind in the neighborhood, were dead and dying. The result was, that notwithstanding the long continuance of the drought, in which nearly all our potatoes, peas, &c. were killed, these squashes were preserved, and yielded a middling crop.

" I also used the compost, as above, on interval land, near the Connecticut river, soil alluvial, no stones or gravel, can be easily compressed, does not bake in the sun, has been cultivated more than one hundred and fifty years, and yields a very scanty crop without manure. The compost was spread over the ground, and ploughed in, at the rate of nine cords to the acre of ground; thus prepared, I planted thirty rods with sugar beets—distance between the rows eighteen inches—

hills eight inches—one seed in a hill. The seeds proved bad, not more than one-third coming up; yet I had 116 bushels of beets; while above an acre of the same land, manured with the best stable manure, at the rate of twelve cords to the acre, did not produce one hundred bushels. Two rows of potatoes were planted next the beets; the land had been designed for beets, and was prepared precisely the same. Between these two rows, and more than an acre immediately adjoining, (where a large quantity of the best barnyard or animal manure was used,) there was a very perceptible difference in favor of the former. I also planted a few hills of potatoes on very sandy land, in the latter part of June. Into the hills I put peat, which had been saturated with lye from the bottom of a soap-tub—no lime. The tops of these potatoes, during the whole drought, were of the most living green, and the most luxuriant growth that I ever beheld. They were killed by the frost in the fall, before maturity—the potatoes were small.

" In conclusion, I would mention, that I am so well pleased with the result of these experiments, on a small scale, that I am now preparing one hundred and fifty cords of peat, and fifty casks of Camden lime, and all the animal manure I can make, to enrich as fast as possible, my whole farm.

" *Expenses*—I get out my peat by ox-team and cart. Three men can, in this way, get out eight cords per day, $4,00; price of lime, $1.50 per cask. My peat being three and a half miles from my barn, that portion of it which I bring home, I estimate to cost me, for carting, one dollar per cord. The peat and the lime for the compost—using one-third of a cask of lime to a cord of peat—there cost me, on the ground near the peat bog—three cords of peat, $1.50—one cask of lime, $1.50; that which I cart home, one dollar per cord more.

" I intend to put about one-sixth part of animal manure, but as it cannot be purchased in any adequate quantity, it is more difficult to fix a price. The nearest place where livery stable manure is sold, is four miles; price there, per cord, $3,00—cost of carting, $1.50.

Five cords of peat, delivered,		$7 50
Two and one-third casks of lime, delivered,		3 50
One cord livery stable manure,	do	4 50
		$15 50

divided by six—the number of cords, not estimating the increase of quantity from the bulk of the lime—gives the cost, two dollars and fifty-eight cents, delivered, or one dollar and fifty-eight cents per cord, at the peat bog.

(Signed.) SAMUEL KEEP."

The importance of peat lands, and their value for fuel and manure, has been urged in the preceding reports on the Geological Survey. The results obtained by practical men, by an application of those principles, will, it is hoped, lead many of our farmers to avail themselves of the bountiful provision of nature for the benefit of their lands. The value of peat bogs may be stated in a few words.

1. Peat is equal in value to oak wood, bulk for bulk.
2. Peat lands are more productive by far, than uplands.
3. Peat manure is more valuable than stable manure.

Bog Iron Ore.

This ore has been found in numerous places, but few localities promise to be of any economical importance.

In Sullivan county, shot ore was observed, but not abundantly, between Monticello and Forestburgh; also, shot and solid bog ore, on Mr. Hamilton's farm, 2½ miles southwest of Monticello. At both these localities, the ore contained black oxide of manganese, sufficient to give it a black colour.

Bog ore occurs on the flats at Deposit, on the Delaware, but as it was in Broome county, and out of the boundaries of my district, I did not visit the locality.

A bed of iron ore was examined near the Delaware, in the township of Tompkins, 4 miles above Cannonsville, Delaware county, on land owned by Mr. Maples, and by a widow lady, whose name is not remembered. Judging from the surface indications, there may be some hundred, perhaps some thousand tons.

Near the village of Delhi, Delaware county, bog ore was observed in some quantity, on the lands of Mr. Titus and Mr. Sherwood. It was discovered by Mr. James Foote, a young man, who has explored the country around with much care. He reported it to be two feet or more thick, and it was seen in so many places in the meadows, as to induce the belief that a stratum of bog iron ore underlies the soil of the flats and mill pond over many acres.

Bog ore was also observed on the flats of the Delaware, on land of Mr. Bela Frost, 2½ miles from Delhi, on the road to Bloomville.

Dr. Henry Marshall, of Kortright, to whom I am indebted for much local information and many kindnesses, informed me of a locality of bog iron ore on the land of Mr. Rich, near Roseville, opposite the mouth of Betty's brook, Delaware county. The ore is said to be abundant.

Bog ore is said to have been ploughed up on the flats of the Wallkill, near Paltz, Ulster county. The locality has not been explored, and the quantity is not known.

Alluvions from Springs.

Calcareous tufa has been observed in several localities during the past season. The most important one is at Sharon Springs, in Sharon, Schoharie county. Several springs, (most of which are strong hepatic or sulphuretted waters,) rise from the ground, and are more or less loaded with carbonates and sulphates of lime, magnesia and iron. The carbonate of lime is the principal deposite, and a mass of tufa, averaging two hundred yards in length, fifty in breadth, and about ten in depth, (or probably 100,000 cubic yards of rock,) has, in the course of time, been precipitated from solution in these waters.

The springs rise from the pyritous slates lying under the Schoharie or Helderberg limestone series, and which we shall have occasion to discuss in another place.*

Helices, leaves of trees, and various plants, are constantly being imbedded in this rock, and the most beautiful specimens of incrusted moss, and the tufa, under various imitative forms, containing shells and vegetable impressions, can be procured.

Another locality of calcareous tufa is about 1¼ miles west of Schoharie, on the road to Cobleskill. It is loose, and can be shovelled up. It may be called a tufaceous marl, and is adapted for agricultural uses.

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* These slates, in the northern part of Schoharie county, almost deserve the name of *barytic* slates, for sulphate of baryta is found in some abundance in them, and has been observed in them in several places, by Mr. John Gebhard, jr. This gentleman was engaged as an assistant on the survey of Schoharie county, and it is in a great degree owing to his indefatigable researches, and minute local knowledge, that I am enabled to speak of many things in that county that would have remained unobserved.

Another is near a limestone spring, by the locality of fibrous sulphate of baryta, in Carlisle, Schoharie county.

Another is at the foot of a ledge of limestone, on the banks of Stoney creek, on land of David Schoonmaker, in the township of Rochester, Ulster county.

These localities are all situated at or near the junction of the pyritous slates with the Helderberg limestone series.

Calcareous tufa is frequently employed for making lime for stucco work and "hard finish;" because in whiteness and purity, it is superior to most other limes.

TERRAINS DE TRANSPORT.

The tertiary and diluvial formations are found in the valleys of all the streams in the district under examination; but as it is difficult to draw any line of demarkation between them, in consequence of the absence of fossil remains, they are in this report classed under the comprehensive and significant term of terrains de transport.

These deposits consist of stratified beds of pebbles, gravel, sand, loam and clay; and by means of the transported fragments and the composition of the clays, we can trace the direction from which these materials have been transported.

The gravel and pebble beds afford fine paving stones, and the sand beds, materials for mortar and the brick manufacture; but the clay beds are far more valuable. The clay beds in the valley of the Schoharie creek, have the same characters as those of the Hudson river, while those of the Delaware and Susquehanna are entirely different.

Bricks are extensively manufactured in Greene and Ulster counties. The principal places of this manufacture are Coxsackie, Athens, Glasco, Catskill, &c. and the average aggregate number made in these two counties may be estimated at 20,000,000 of bricks per annum.

The range of the main body of the tertiary clay and sand beds in Greene and Ulster counties, is from a few miles north of Coxsackie, by that village and the landing, up the Coxsackie and down Murderer's creeks, to Athens, thence to Catskill, and thence down the Hudson four or five miles, with a variable breadth, from 100 yards to two or three miles. It occurs again at Saugerties, ranges by Glasco, near which it leaves the Hudson and passing among the limestone and slate hills which are as islands, it ranges by Kingston, Bolton and Eddyville. From Rosendale it ranges across the northeast point of the Shawangunk mountains, (the grit rock of which disappears beneath it,) south to the Wallkill, and a few miles up that stream.

The clay and loam lands of this formation have long been held in high repute, but it is only within a few years that these light and sandy soils have begun to be appreciated. They are easy lands to till, and by means of plastering and clovering, they make soils of the best quality.

IV. CATSKILL MOUNTAIN SERIES.

The next group of rocks in the district under examination, and the most recent of the consolidated formations, is that which lies between the Helderberg limestone series, and the coal bearing rocks of Carbondale in Pennsylvania. It contains the "olive sandstones," "dark coloured shales," and "black slate" of groups 8 and 9 of Mr. Conrad's Report of 1839; and formations viii. ix. x. and xi. of Professor Rodger's Report on the geology of Pennsylvania for 1838, viz: the part of the "olive slates" above the limestone formation, the "red sandstones and shales," the "sandstones and conglomerates," and the "red shale of the anthracite coal regions."

The Catskill mountain series consists of coarse and fine grits, grayish, greenish and various shades of red and brown, which lie thick bedded, with water lines of deposition strongly marked where a cross fracture exhibits the structure; conglomerates of various degrees of coarseness, grayish, greenish and red; slaty sandstones, with slates and shales of various colours, as red, green, spotted, gray and black.

Testacea are the principal fossils of the lower, and plants of the upper portions of the series.

The general arrangement of parts of this series is

1. Conglomerates and coarse grits.
2. Red shales, slates and grits.
3. Gray slaty grits.
4. Chocolate grits with red shales and slates.
5. Gray grits and bluish shales, among which are the flag stones.
6. The olive slates and shales over the Helderberg series.

This formation occupies the county of Delaware, and by far the largest portions of the counties of Sullivan, Ulster, Greene and Schoharie. Seams and layers of pure anthracite have been observed in some places, and fossil plants similar to those of the coal beds of Carbondale have been found, not only in the shales associated with the anthracite, but also abundantly in the grits and slaty sandstones of the middle and upper parts of the series. These strata are all, perhaps, below the coal bearing rocks of Pennsylvania, and it is not considered probable that coal will be found in useful quantity in them; still, some parts of the upper portions bear so much resemblance to the anthracite coal rocks of Pennsylvania, both in mineralogical character and fossil remains, that it is thought *possible*, that coal beds of workable thickness may be discovered.

The Catskill mountain group is exceedingly barren of useful minerals.

Small quantities of copper, lead, zinc and iron ores were seen extensively diffused in a particular stratum of rock, in various parts of Greene, Ulster, Sullivan and Delaware counties, but the stratum was nowhere more than eighteen inches thick. It was generally a calcareous conglomerate or breccia, formed of small masses of limestone, imbedded in a reddish or brownish paste of the underlaying shale bed.* Sometimes the rounded nodules are of carbonate of iron, and more rarely of galena, blende, sulphuret of copper, and the green and blue carbonates of copper. Black oxide of manganese in a earthy form was also seen. This stratum, although thin, seems to be co-extensive with the formation in which it was observed. The underlaying shales, and the overlaying slaty grits, frequently abound with vegetable impressions, the original vegetable matter of which is sometimes converted into anthracite, and sometimes replaced by blende, oxide of iron, black oxide of manganese, black sulphuret of copper, or by the blue or green carbonate of copper. Although these materials were observed in several places, as in Franklin, Delhi, Roxbury, Windham, Durham, Monticello, &c. yet, no localities were seen where they existed in such apparent quantities as to be of any economical importance.

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* This stratum when exposed to the weather becomes more or less porous and cellular, from the solvent action of the water upon the calcareous ingredient. Considerable quantities of it are seen scattered over the fields, and it has acquired the name of *fire-itone* in some of these counties, in consequence of its resisting the effects of common fires, not cracking to pieces. Almost all the common grits of the country, when heated, burst to pieces with loud explosions, or else exfoliate and crumble by heat.

One of these localities on Gooseberry hill, ¾ of a mile east of Delhi, in Delaware county, has been called the coal mine. It is a seam of the gray slaty grit, about eight inches thick, containing many imperfect vegetable impressions. In some of these, the original plant is changed to anthracite, in others, it is replaced by earthy black oxide of manganese, by crystalline sulphuret of zinc, by sulphuret of copper, (black,) or by the carbonate of copper. None of these minerals are in any valuable quantity, and it is difficult even, to procure a fair suite of specimens. The upper part of Gooseberry hill is said to be about 450 feet above the Delaware, which flows at its base, and is composed of gray slaty grit, some of which splits out in plates ¼ to ¾ inch thick. Some of these plates have been used for covering the roof of a log building instead of shingles. They are not heavier than the large slates, or the common tiles, are indestructible and impermeable to water. They may, perhaps, be used for roofing at some future time, if they can be got out of regular sizes and shapes, and pierced for nails without too much waste and expense.

Another of these localities of copper ore was examined on the land of Judge Beach of Franklin, Delaware county. Here are the same beds of slaty grit and of shale filled with vegetable impressions, as were observed on Gooseberry hill, also a similar bed of breccia or conglomerate, containing the carbonate of iron, and the blue and green carbonates of copper. A few rods below is what has been called a mineral spring, though I could not by *tasting*, detect any mineral qualities. It had acquired the name of a mineral spring, in consequence of some person from New-York, (who stated that he was engaged on the Geological survey of the State, but who had no connection with it,) having assured the proprietor that it was a valuable mineral spring. It is a tolerably copious spring of very pure water, and which had been in use by the Indians, long before the settlement of the country by the whites.

The copper mine, as it is called, in Roxbury, Delaware county, is on the land of Mr. Leonard, on the Beaver-dam creek, about 3½ miles from Roxbury village, on the road to Mooresville. A little copper ore was observed in the beds of shale and conglomerate. Whether the supposed body of ore was expected to be discovered in the bed of shale, or in a vein which appears as a broad fissure in the rocks, is not now known. This "mine" was opened before the French war of 1755, and re-opened in 1827 or 1828. Indications of copper are said to have been very distinct, when last opened, by gentlemen in whom I can place confidence. Scarce any traces of copper are visible among the rubbish of the mine at the present time. The son of the owner informed me that the Germans who came there last to open the mine, some years since, tried the water of a spring from the hill side, and found it to contain copper. He gave their mode of trial as follows. "Water from the spring was boiled down to a small quantity in an *iron kettle;* a silver sixpenny piece was then introduced, and taken out coated with copper." Any one acquainted with the relative chemical affinities, knows this to be impossible, as the copper, if any, would be precipitated by the iron of the kettle. Copper would precipitate silver from solution, but silver would not precipitate copper under such circumstances. Some deception must have been practised, if the above statement of the process be correct.

Another mine, a "silver mine" as it was called, was showed me on the bank of Dry brook, about three miles above Arkville, which is at the junction of the Bushkill and Dry brook, with the east branch of the Delaware. A handsome adit has been excavated at the juncture of the gray grit with the red shale, leaving the former rock as a solid substantial rock roof. At the end of the adit, which penetrates horizontally some 30 or 40 feet, a shaft has been sunk, and it is said that rooms of some size have been excavated in the rock below, but the shaft was full of water, so that nothing more could be examined than the adit. The mineral which is supposed to have caused this excavation, was common pyrites, which abounds at the junction of the grit and shale. It decomposes readily, causing the shale to crumble away by its decomposing action and the crystallizing power of the resulting salts. Copperas (sulphate of iron,) was observed in some abundance efflorescing from the surface of the rock, and could be scraped off in handsful. The excavation was made many years ago by some Germans, and silver is reputed to have been obtained, but I saw no traces of any other ore than the common iron pyrites, (bisulphuret of iron.) Col. Noah Dimmick of Arkville, had the kindness to pilot me to the locality.

Mr. James Foote and Mr. Wood of Delhi, brought me specimens of the black sulphuret, and of the blue and green carbonates of copper, in the gritty shale containing vegetable impressions. If the stratum from which they obtained their specimens is of the thickness of two feet, and as rich as the specimens they exhibited to me, it would be important for exploration. As they did not communicate to me the locality, I can form no judgment of its importance.

A "coal mine" has been opened in Sullivan county, about 1½ miles west of Red Bridge, which latter place is where the line between Ulster and Sullivan is crossed by the Delaware and Hudson canal. It is a bed of black carbonaceous shale, 4½ to 5 feet thick, with thin seams of anthracite interlaminated, from the thickness of paper to that of thick pasteboard. The shale contains vegetable impressions similar to some of those at Carbondale. It has been opened on the right bank of the Sandberg creek, about 30 feet deep in the dip of the strata, and a seam of pure anthracite *is said* to occur in the shale, six to nine inches thick. I did not see this, the mine being filled with water. A shaft has been sunk — feet, with the expectation of striking the coal at the depth of aboout 150 feet, and of finding it there to be thicker. The strata dip about 30° to 40° to the west-northwest, and there is so little back to the seam, at such depths as would be of easy drainage, that if a coal bed of 5 feet thick could be found there, it is perhaps doubtful whether it could compete successfully with the Carbondale and other coal beds of Pennsylvania. It could not perhaps be drained without expensive and powerful steam engines and pumps, to a greater depth than 200 feet, giving a back of about 100 yards in the direction of the outcrop, or 100 tons of coal per yard in length of the seam for each yard in thickness.

It is presumed there are no seams of workable coal in this vicinity, still, if there is a coal formation in the portion of the State under my examination, it will probably be found in this region. From the Shawangunk mountains westward by the mine, the whole series of rocks in this part of my district, are upturned on their edges. The rocks at the mine are 1,000 to 1,500 feet above the fossiliferous slaty grits. These grits abound with the most beautiful fossils, about ½ mile east of the mine. At no great distance westward of the mine, the strata become nearly horizontal, conforming to the general position of this series of rocks in Sullivan, Ulster, Greene, Delaware and Schoharie counties.

Flagging stones, grindstones, &c.

The only rock of the Catskill mountain series that is applied *extensively* to useful purposes, is a bluish gray slaty sandstone, which is quarried as a flagging stone. It has various local names, as the Saugerties, Kingston, Coxsackie, and North River flag stones. This stone forms a stratum which is generally about two feet in thickness, and can be split out in slabs of from 10 to 100 square feet, and from one to four inches thick. The rock is traversed by joints that divide the slabs about perpendicular to their layers, and smooth as if cut by a saw. There are two, sometimes three sets of these joints which divide the rock into regular blocks, and facilitate the labors of the quarrymen. Similar joints traverse the whole rock series under examination, (viz: the Catskill mountain group.) These joints are remarkable for their smoothness, and are nearly uniform in their directions.

The stratum of flag stone is from 700 to 1,000 feet above the Helderberg limestone series. It is quarried in Sullivan county for the supply of that and Orange counties; but the principal quarries are in Ulster, Greene and Albany counties. It has been estimated that fifty loads per day pass through Kingston to the landing for five months in the year, for shipment to New-York and other places, which would give about 900,000 feet as the amount shipped from Kingston. Saugerties, Coxsackie, Bristol and New-Baltimore, send in the aggregate about 2,500,000 feet more. The aggregate amount of flagging stone quarried in Sullivan, Ulster, Greene and Albany counties, may be supposed to be about 3,500,000 feet per annum.

The principal quarries near Kingston, are owned by Judge Hasbrouck, who leases them to the quarrymen for $5 per M feet, and as each square yard will give on an average from 50 to 70 feet, each acre may be conceived to yield 300,000 feet, and thus give the proprietor a clear income of $1,500 per acre, from land which was purchased a few years since for one dollar per acre.

This rock ranges from the Delaware river, through Sullivan and Ulster counties, nearly parallel to the Delaware and Hudson canal, to within 4 or 5 miles of Kingston; thence nearly parallel to the Hudson to opposite Saugerties; thence around the Catskills to the mountains east of Rensselaerville; and thence westward through Schoharie county, a distance of about 140 miles, without reckoning the winding line of outcrop, in consequence of various irregularities of the ground.

The flag stone rock, like many others of this series that do not disintegrate by exposure to the weather, frequently forms terraces, and in many places it is but slightly covered by soil, or by a thin stratum of rock which is similar to this, except that it does not split as regularly. The quarrymen select such places as present the least obstruction to working, and are nearest to good roads leading to the Hudson river. The strata lie nearly horizontal, pitching very slightly to the northwest from the Delaware to Woodstock,* then westward to east of Rensselaerville, then southwestward and southward to Summit in Schoharie county.

Other varieties of the grits of the Catskill mountain series are quarried to some extent for *grindstones*, for which some of the strata are well adapted. *Rubstones* or *whetstones* of various degrees of fineness, hardness and sharpness of grit, might be procured, and have been obtained in Monticello, on both branches of the Delaware, and on the Beaverkill and Willewemack river. Grindstones are quarried in Cobleskill and Fulton in Schoharie county.

Some of the shales that crumble by exposure to the weather, would, it is believed, be useful as mineral manures or marls on the lighter soils of this region. They contain more or less lime and some pyrites, and by decomposition would form a portion of sulphate of lime or gypsum. There are numerous strata of red, gray and black shales in this formation, that crumble easily, and when quarried, require nothing more than exposure to the frosts and weather to prepare them for strewing over the soil.

Beautiful building stones have been quarried from the Catskill mountain series in many places, which come out of the quarry in regular layers, from 6 to 15 inches thick, with faces along the joints of the rock perpendicular to the layers, and smooth as if sawed. They have been particularly noticed in Meredith and Kortright, in Delaware county, and near the mouth of the Willewemack river, in Sullivan county.

Brine springs, licks, &c.

Salt water occurs in the Catskill mountain series in Delaware, and probably in some of the other counties. Deer licks are numerous in Delaware county, but these are not always an indication of salt water, for wild animals will lick the clay and rocks where there is almost any soluble saline substance. Salt is said to have been formerly made by the hunters on the farm of George Dane, 3½ miles from the village of Colchester, on the east fork of the west branch of Downes' brook, near the road from Walton to Colchester. The water was scarcely perceptibly saline at the time of my visit; but deer and cattle constantly resort to it to drink the water.

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* From the Delaware to Wawarsing, the strata next the valley of the Delaware and Hudson canal are all upturned at a high angle, and the flag stone stratum throughout this distance is upheaved in the same way as the adjacent rocks.

A salt well was bored to the depth of 394 feet in the valley of Elk creek, about 3½ miles from the village of Delhi, at one of the Deer licks, and salt water was obtained, which increased in strength, in proportion as the well was sunk to a greater depth. The water is a pretty strong brine, and carburetted hydrogen is constantly rising in bubbles through the water in the well. The amount of the supply of the water, and its exact strength were not measured. Several hundred barrels of salt have been made at this well, and it is said to have been very white and a superior article for table use.

Ten bushels of salt were made per day with two cords of wood in eight kettles, as I was informed. Wood is cheap in the vicinity, and if the supply of water is abundant, the well could probably be worked with profit for the local supply of the country around, if not for a more distant market. All the salt used in that region is now brought from the Erie canal, or from the Hudson river, a distance of 60 to 80 miles.

The water of this salt well when kept a few days, smells like free iodine, and probably the water may contain this substance in some form of combination, and perhaps in some quantity.

It is thought that salt water in useful quantities may be obtained, by boring to some depth in the valleys of either branch of the Delaware. The rocks between the Susquehanna and the Catskill mountains dip slightly towards the valley of the Delaware, and in Schoharie county they dip southward, giving a basin shaped form to the stratification. It is a fact that has been forced upon my attention by extended observation, that many of our salt well districts in the United States, are in depressions of the strata; in other words, they are within the undulations, as troughs or basins in the strata.

Whatever be the origin of the salt water of our salt wells and licks, whether from salt in mass, or disseminated in the superincumbent rocks, as some of my colleagues and others believe, or from the water of the ocean, (for there is indubitable evidence that it formerly covered all these rocks,) the *fact* that *salt water* is *generally* found in such depressions of the strata, is believed capable of demonstration.

Mineral Springs.

A chalybeate spring was observed between Sidney Plains and Unadilla, on the left hand side of the road that leads up the left bank of the Susquehannah.

A similar one was seen between Unadilla and Franklin, in Delaware county.

Another, discharging a considerable quantity of water, occurs in the meadow of the brook, about 2 miles from Bloomville, on the road to Kortright-Centre, on land of Nehemiah Every, Delaware county.

Chalybeate waters flow from the marsh on the Beaverdam flats, ¼ mile above the mouth of Stratton's falls brook. Most of the springs are now covered over, in consequence of a bed of gravel and stones having been swept into the Delaware,* during the heavy freshet of last winter, by the Stratton's falls brook, and which has dammed up the former stream about two feet.

Mr. Reed, of Hancock, informed me of a mineral spring in that township, on the east branch of the Delaware, on Mr. Thomas' farm, three miles above Shahocton, in Delaware county. From the description, it is probably a sulphur spring. I did not see it. Ferruginous deposits, indicating chalybeate springs, were observed in many places along the route of the Erie rail-road, between Shahocton and Deposit, but most abundantly within four or five miles of Shahocton.

Another chalybeate spring was seen on the farm of James Weed, in the township of Walton, three miles above the village, in the valley of the west branch of the Delaware, in Delaware county. Bog ore is deposited from this water.

A sulphur spring rises from the alluvial gravel over the slate rocks of the Catskill mountain series, on the bank of creek, about

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* The upper part of the east branch of the Delaware, above the mouth of the Bushkill and Dry brook, is called the Beaverdam creek. Its name is appropriate, as it was formerly dammed up in many places by the beavers, which were once numerous on this stream. Long narrow ponds, of nearly still water, were formed in this way, and sometimes, also, by causes similar to that above mentioned, viz. by alluvial action.

¾ of a mile west of Greenville, Greene county, on land of Francis Hikok, Esq. It is well located, within a few miles of the Hudson river, in a highly cultivated country, and in the bracing air of the Catskill mountains.

A chalybeate spring was observed three miles from Oak-Hill, on the road to Freehold, north of the turnpike, on the farm of Walter Barlow. The owner did not know of it until informed.

A mineral spring is said to occur near North-Blenheim post office. I did not see it.

A sulphur spring was visited in Rensselaerville, Albany county, in the valley of Fox creek, three miles from Preston Hollow. This is a moderately strong hepatic water, and flows at the rate of a gallon in four or five minutes. It is much used by the people in the vicinity. It is said to be somewhat diuretic in its effects. The spring is on the farm of Mr. Weeden.

III. HELDERBERG LIMESTONE GROUP.

This group embraces a series of limestones, varied in mineralogical character, in chemical composition, and which abounds in fossil remains. It contains subordinate beds of shales, slates and silicious grits. It skirts the group of rocks last described, in a parallel zone, and underlies them, it is supposed, through their whole extent.

This formation extends in the district under examination, from Sharon Springs, in Schoharie county, by Schoharie, to the northeast part of the Helderberg mountains ; thence southeast, to near New-Baltimore ; thence southwardly, by Catskill and Saugerties, to Rondout ; thence up the valley of the Rondout, by Rochester, Wawarsing and Ellenville ; thence on through the Mamakatting valley, by Cuddebackville, to Carpenter's Point, on the Delaware. At the latter place, it passes out of the State of New-York into New-Jersey, and crosses the Delaware into Pennsylvania, at the Walpack bend of the Delaware, according to Professor Rogers.*

This formation varies much in its subordinate beds in different localities, particular beds being either entirely wanting, or replaced by others ; but its fossil contents are nearly uniform. Mr. John Gebhard, jr. of Schoharie, who was the assistant for Schoharie county, has examined this group with much attention for several years, and he has a more perfect collection of the fossil remains of its various strata than any other individual.

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* Vide Professor Rogers' 2d Annual Report on the Geological Survey of Pennsylvania, p. 56.

The Helderberg series is a part of Prof. Rogers' " olive slate group," or formation No. 8, in his 2d report on the geological survey of Pennsylvania ; No. 7 of Mr. Conrad's synopsis of the rocks of New-York, in his 2d palæontological report, or as he conceives, the upper part of the medial silurian strata of Mr. Murchison. It is also the upper limestones and water limestone series of Prof. Vanuxem's 2d annual report on the geology of New-York.

The lower strata of this series of rocks consists of various beds of common and hydraulic limestones, varying much in thickness and quality, even in contiguous quarries. These strata sometimes rest unconformably upon the Hudson slate group, as at Lawrence's quarry, on the Rondout, opposite Wilbur ; sometimes conformably on the Shawangunk grit, (mill-stone grit of Eaton,) as at Rosendale and Lawrenceville, on the Rondout ; sometimes on the red and variegated shales and grits that overlie the Shawangunk grits, as at the High Falls of the Rondout, in Marbletown ; and upon the shales and grits of Schenectady, and the north part of Schoharie county.

The following section, most of the details of which were procured by Mr, John Gebhard, jr. indicates the principal masses of this group at Schoharie.

1. Grey calcareous sandstone, abounding with fossils.

2. Corniferous limestone, containing many layers and courses of nodules of chert and hornstone.

3. Cocktail grit of Dr. Eights, characterized by fucoides caudagalli.

4. Sparry limestone,* highly crystalline in texture, and containing many fine fossils.

5. Shale.

6. Pentamerus limestone, capped by a thin silicious stratum, containing many fine fossils.

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* This limestone, called by Mr. Gebhard, sparry limestone, is very different in aspect and geological position from that called by this name by Prof. Eaton. Mr. G's. sparry limestone will have a suitable name when its fossils shall have been described by Mr. Conrad.

7. Tentaculite limestone.
8. Water limestones.
9. Pyritous slates.

Near New-Baltimore, Coxsackie, and thence on by Catskill, Kingsston and Rochester, the principal masses of this formation are similar to those of Becraft's mountain, near Hudson, and contain the pentamerus limestone, tentaculite limestone, and water limestone. In some places the sparry limestone* and shale are found in addition to the preceding, which are the principal extensive strata of this formation, in the district under examination this year.

Economical applications of the materials of this group.

The materials in the Helderberg limestone group, that are applicable to useful purposes, are,

1. Limestones, for building stone.
2. " " marbles.
3. " " common lime.
4. Cement rock for hydraulic lime.
5. Pyritiferous slate, for alum, copperas and sulphate of lime.

Building stones and marbles.

The pentamerus, tentaculite and water limestones, all afford fine building stones, which can be procured in blocks of large size, perfectly solid, and free from cracks or flaws, in many parts of the range of these rocks, which extends in a curved line 140 miles. Through this long distance, the outcrop of these rocks is not concealed more than 20 or 25 miles, and this only at intervals of a few miles, where they are covered by the tertiary and alluvial deposits of the Mamakatting valley, between Rochester and the Delaware river at Carpenter's point.

Numerous quarries may be opened near to water transportation, for the supply of the New-York and other markets, from the "High Rocks" above Kingston point, by Rondout, Eddyville, Rosendale, Lawrenceville, High-Falls, Rochester and Wawarsing, and which shall be within a few rods to one half mile of canal or river navigation.

Strata of these rocks are from a few inches to 3 feet thick, from which the stone can be taken out in regular and sound blocks of almost any desired size.

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* See note on page 237.

These stones vary from ash gray to black, and present almost every shade between these colours. Blocks may be selected of uniform texture. As handsome stones can be procured here as at the celebrated Amsterdam quarries, where so many are quarried for the Erie canal, and for the Albany, Troy and New-York markets.

The blocks from some of these beds are susceptible of a high polish, and will undoubtedly make as handsome and valuable black and dark coloured marbles, as those at Glenn's-Falls and Swanton.

Lime and hydraulic cement.

Quick lime is made from particular beds of every part of the Helderberg series. It is not made in such quantities as to deserve particular notice. In Schoharie county, it is supposed that about 20,000 bushels are made annually for manure, building, and for the supply of Delaware county, which it is believed has no beds of limestone suitable for burning.

Between Wilbur and Eddyville, are four limekilns for making quicklime, belonging to Mr. Hamilton and Mr. Dubois. These kilns are supplied with limestone from strata that lie between strata of cement rock. They are on the bank of the Rondout, and offer every facility for easy transport. These and other kilns in Ulster county probably make 40,000 bushels per annum.

The beds of limestone that yield hydraulic cement are extensively worked in the vicinity of Kingston, Rosendale, Lawrenceville and High-Falls.

Lawrence & Austin,	2	kilns	between Kingston landing and Eddyville.
Benjamin & Co.	2	“	and steam mill for grinding.
Taylor & Little,	2	“	between Kingston landing and Eddyville.
Thaddeus Phelps,	3	“	“ “ “
McNulty & Chapman,	2	“	“ “ “
Whiting & Weeks,	2	“	“ “ “
Dusenbury,	1	“	at Eddyville.
White & Co.	15	“	between Kingston and Rosendale.
———,	2	“	at Bridgeport, near Rosendale.
Flint,	3	“	1½ miles north of Bridgeport.
Lawrence & Co.	13	“	at Lawrenceville, near Rosendale.
O'Neil,	2	“	on Coxen-clove creek S. W. of “
———,	2	“	on Rondout above Lawrenceville.

Isaac Hasbrouck, . .	4	kilns	High-Falls of Rondout.
Tho's D. Robinson,	2	"	¼ mile above High-Falls.
————, ...	3	"	4 or 5 miles above High-Falls.
Total number, ...	60		

There are 60 kilns for the manufacture of cement, each of which, on an average, may be estimated to yield 40 barrels per diem, when in operation. Most of the kilns are in operation as perpetual kilns, during the warmer season of the year, when the Hudson river is navigable. In June last, it was estimated that 600,000 barrels of cement would be sent to market from those kilns during the past season. It was said that 500,000 barrels were manufactured there during the previous season. The Croton water works and the various government works consume large quantities of this cement, and its uses for various hydraulic works and for cisterns, wet cellars, &c. cause a continually increasing consumption. It is shipped to all our Atlantic ports and to the West Indies.

White's quarries and kilns are the most numerous, and turn off about 600 barrels of cement per diem. Mr. White contracts with the quarrymen to quarry and burn the stone for 25 cents per barrel, while he furnishes the fuel, (dust anthracite from screened coal,) delivered at the kilns, removes the cement to the mills, grinds and barrels it.

The kilns are built something in the form of a high furnace, except the hearth, which has a sloping sole of 40° to 45° from the back of the kiln to the floor of the drawing arch at the base. These kilns are kept in perpetual operation several months, and are charged like a high furnace. The dust anthracite and broken cement rock are charged, as usual in perpetual kilns, twice in 24 hours, each charge being introduced in successive layers at the top of the kiln, after a quantity of cement has been hauled out from the sole of the kiln, into the shed next the drawing arch. About a ton of dust anthracite is used daily in a kiln that burns 40 barrels per diem. The kilns are usually built double or triple, that is, two or three, or even more, are built in one stack, one set of men being sufficient to attend several kilns. Some have roofs over them, others have not, but *all* have sheds over the drawing arches, in consequence of the necessity of protecting the cement from the weather.

At Lawrence's works, there are two blocks of kilns, one containing 6 kilns and the other 7. The quarries, kilns, mills for grinding, and barrel factory, are almost contiguous, and on the banks of the Delaware and Hudson canal. These works economize labor and transportation more than any others I have seen connected with the cement manufacture, and they turn off from 1,500 to 3,000 barrels of cement per week.

The cement business of Ulster county gives direct employment to at least 700 men, as quarrymen, burners, teamsters, millers, packers, coopers, and those engaged in transporting the article to New-York; and indirectly it affords employment and profit to many others.

When making the reconnoisance, soon after the commencement of the survey, this business had but commenced, and there was no cement manufactured on the Rondout, except at Lawrenceville, and there, but few kilns were in operation. It was not then known to the inhabitants that the cement rock was abundant, except at and near those quarries, until some of them were then informed of its inexhaustible quantities. Even now, few are aware of the great extent of this rock, and still fewer understand how to trace out the situation of favorably located new quarries.

The cement beds and overlying limestones, up the valley of the Rondout, (and in fact north to New-Baltimore,) are very much broken up, upheaved, overturned even, and contorted very much. As the facts connected with this derangement of the strata have a practical bearing, in exposing the cement beds so as to render them capable of being worked with the minimum expense, in a multitude of localities where they would not otherwise be accessible, it is thought proper to introduce some details that would, under other circumstances, have been reserved for the final report.

Between Kingston and Wilbur, the strata are very much broken and contorted, having been traversed by numerous extensive faults and disruptions ;and where these have not occurred, the strata are bent and contorted in a remarkable manner. At some of the quarries on the hill near Wilbur, the strata approach to a horizontal position, but they bend down more and more, until they pitch under the Rondout river, at angles of 40° to 50° and 60°. On the opposite shore, the same strata show their broken ends on the mural precipice that rises from the water, and their dip is slight, and in the same direction as the more moderate dip at the quarries on the top of the hill. The river here flows along a line of fault.

At White's quarries, which are numerous, the rocks generally dip to the east-southeast, at angles from 35° to 45°; but there are some, where the strata are nearly vertical; in one they are reversed and dip 75° to 85° degrees to the west-northwest, and in one they are nearly horizontal. There are generally two or three strata of the cement rock with seams of calcareous slate or shale between, varying from four to twenty feet thick; and again, other strata of the cement are separated by strata of limestone twenty or thirty feet thick. Each hill seems to have been formed by the strata cracking in parallel lines, and then being upheaved or down-heaved on one side or on a diagonal line, while the opposite side or angle remained fixed. The same strata are seen in each hill and in the same order of succession, except in some few cases of overturn, where the strata are reversed.

On Pine mountain, between Rondout and Kingston point, is a high cliff of limestone overlaying the gray grits of the Hudson slate series. The strata of these grits are from 8 to 20 inches thick, homogenous in texture, and divided into blocks by joints, which traverse the rocks in parallel directions with regard to the planes of stratification. The strata of this rock here dip to the east-southeast at angles of 40° to 60°. The overlaying limestone along the brow of the hill and at the cement beds of Hasbrouck's quarries* dip about 80° west-northwest, and this dip continues nearly uniform along this line of upheave to the "High-Rocks" above Kingston point.

At Lawrence's quarry, opposite Wilbur, at the southwest end of the limestone hill on the right bank of the Rondout, is a fine exposure of the different strata, and the Hudson slates are seen *unconformable*, below the limestones.

The following is an approximative section of the rocks at the south-southwest end of that hill.

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* Mr, Hasbrouck has three quarries leased out on Pine mountain, between Rondout and Kingston point. One of them 650 feet in length is leased for $250 per annum, and yields about 40 tons of cement rock per diem, which is sent to Newark, New-Jersey to be burned.

1.	Fossiliferous limestone like the "middle limestone of Becraft's mountain,"	60 feet.
2.	Fossiliferous limestone, different from the above, and containing hornstone,	50
3.	Compact dark gray limestone, (pentamerus,)	34
4.	Clouded striped limestone,	20
5.	*Cement rock*, (gray,)	2
6.	Compact black limestone,	1
7.	*Cement rock*, (gray,) four strata,	12
8.	Black coralline limestone, (various radiaria,)	8
9.	*Cement rock*, (gray to black,)	8
10.	Limestone, dark coloured, impure and fossiliferous,	8
	Thickness of the limestones and cements,	203 feet.
11.	Hudson slates and grits, thickness unknown.	

At the extreme southwest end of the hill, the strata are much deranged and bent, but a little farther east, at the quarries, and along the face of the cliff, they are finely exposed, dipping at a moderate angle to the east-southeast.

There is an anticlinal axis along the broken ridge between the Esopus creek and the Rondout. The rocks on the northwest of this axis dip to the west-northwest, at a small angle conformable to the general dip of the rocks which overlie them on the northwest side of the valley, and which do not appear to have been much disturbed by the upheaving action that has dislocated and upturned all the rocks east and south of this valley. On the southeast of this axis, the strata are broken and upheaved, dip to the south-southeast, at angles from 20° to 80°, and present successive mural escarpments. There are several anticlinal lines, and lines of fault parallel and subordinate to the main one. One passes through two small lakes in Marbletown. A high mural precipice originating in a fault passes along the east shore, while two long promontories with arched strata stretch far into the lake from its extremities. The same continues to the other pond, and the continuation of this fault and anticlinal axis is easily traced thence by the eye over the whole line of hills, to the summit of the Shawangunk mountain, ranging south 15° to 20° west. This line of fault continues south-southwest by Flint's quarries, between which and Bridgeport, it forms the high mural scarp of   mountain on its west side, thence across the country from Bridgeport, with mural escarpments, to a high cliff on the Shawangunk.

Other lines of fault are seen at Lawrenceville, and which may be traced to cliffs on the Shawangunk. Near Lawrenceville, the limestone beds may be seen downheaved, and abutting against the Shawangunk grit (which underlies) by successive faults.

A disruption, or double line of fault, with an included anticlinal axis, may be seen between the upper end of Lawrenceville and the bridge across the Rondout, on the road to High-Falls. It extends south 20° west, to the gap on the Shawangunk mountain, where the same appearance presents itself, and which can be seen on the opposite side of the mountain from many parts of Orange county.

Various sections and diagrams will illustrate these and numerous similar facts in the final report.

Pyritous Stratum.

This rock has but a small thickness in the counties under examination, but in other parts of the State it becomes an important rock, the equivalent, it is believed, of the "gypseous deposit" of Prof. Vanuxem, in the central and western parts of the State. Its geological position in Schoharie, Greene, Ulster and Sullivan counties, is next below the "water limestone series," (lower part of the Helderberg limstone series,) and above the red and green shales that overlie the Shawangunk grits. No beds of gypsum have been discovered in connexion with this stratum in any part of its range in the 1st geological district, but where the lower beds of the water lime series are pyritiferous, as they frequently are, this material might be used with the same useful effects as would be obtained by the use of gypsum.

At High-Falls on the Rondout, in Marbletown, Ulster couunty, this stratum, which is there a slaty bluish limestone, occurs above the red shales that overlie the Shawangunk grit. The following is a section of the rocks at that place, above the bridge, and near the bend of the creek, on its left bank below the falls.

1. Cement rock,	12 to	15 feet.
2. Limestone,	10	30
3. Cement rock,	6	8
4. *Pyritous slaty limestone,*	4	10
5. Red shale with green spots, containing nodules and crystals of pyrites, and thin bands of gray compact limestone,	15	20
6. Conglomerate or Shawangunk grit, unknown thickness.		

The red shale and slate, No. 5 of the above section, may perhaps, for economical purposes, be called a *red marl.* It contains some lime, and there are several thin bands of limestone. The whole of this stratum has the aspect and composition of the red marl rock of Rockland county, described in the third annual report.

The pyritous slaty limestone lying next above, is more or less argillaceous, and loaded with crystallized pyrites, which are continually decomposing and forming gypsum. The mineral thus formed coats the rocks in brilliant druses or flocky and acicular efflorescences. Epsom salts are also formed, if the taste is to be trusted; and Mr. Robinson the owner of the locality, says, that the saline matter sparkles or deflagrates slightly when thrown on red hot coals. This sparkling would indicate the presence of nitrate of lime.

I advised Mr. Robinson to grind some of the pyritous limestone and red marl, as they are easily crushed, and when spread on the ground and exposed to the weather, both would give rise to the formation of gypsum, by the decompositon of the pyrites and the combination of the sulphuric acid thus formed with the lime. The slaty limestone is rich in pyrites, minute crystals of which are disseminated through its mass; and judging from the relative proportions of pyrites and limestone, it is supposed that this material, when ground or crushed might be worth as much for use as one half of its weight of pure gypsum.

Should it ever be deemed expedient to work the stratum, numerous localities might be found in the vicinity.

At Schoharie, near the bridge over the creek, the stratum containing the pyrites is exposed, underlying the Helderberg or Schoharie limestone series. This locality has been long known in consequence of the fine crystals and groups of crystals imbedded in the decomposed clayey green shale.

Many places were observed, where the same crumbling green shale, interlaminated with limestone, and containing an abundance of pyrites, was underlying the Helderberg limestone series. The slate, or dark colored shale, which contains the fibrous sulphate of baryta, lies directly below the pyritous rock in Carlisle and Sharon, in Schoharie county.

It is thought probable that localities may be discovered in the pyritous stratum, where copperas, and perhaps alum, may be manufactured with advantage.

II. SHAWANGUNK GRIT.

This rock varies in texture, from a conglomerate to a fine grained grit rock, and it is almost entirely silicious. It is generally white or light gray in colour, but there is one bed at the upper part of its mass, that is red.

The mountain on which the grit rock abounds has taken its name from the predominant colour of the rock,—the word Shawangunk meaning, it is said, in the language of the aborigines of the country, *white rocks.*

The Shawangunk grit has not a *very* extensive range in the 1st geological district of New-York, but in New-Jersey and Pennsylvania, it is reported by Prof. Rodgers to be more largely developed. It extends in an almost unbroken range, from the New-Jersey line, on the top of the Shawangunk mountains, to Rosendale, near Kingston, a distance of 43 miles, where it disappears beneath the water limestone and the tertiary deposits of the Hudson valley. On the higher parts of the Shawangunk mountains, it generally lies in nearly horizontal strata, often thick bedded, and presenting mural escarpments of broken ends of the strata, 30 to 200 feet high. Some places on the eastern face of the mountain, present the strata with a high dip to the east-southeast; but on the western face, the dip is almost uniformly to the west-northwest and northwest, at variable angles. That part of the range about Wurtsboro', Ellenville and Wawarsing, shows a dip from 30° to 60° to the west and northwest; but with some local exceptions, the dip of the grit rock towards either extremity of the range is less, and does not generally exceed 8° to 15°.

The thickness of the Shawangunk grits is variable, but its maximum is believed to be less than 500 feet, and its usual thickness is from 60 to 150 feet.

The strata are traversed by two great systems of fracture, one longitudinal, and approaching more or less to the direction of the strike, the other transverse. Their usual directions are south 20° west, and north 20° east, for the first, and south 60° east, and north 60° west, for the second.

When the elevatory movement has been along the *transverse* fractures, the dip is sometimes to the north-northeast, but most frequently to the south-southwest; and when the upheave has been along the *longitudinal* fractures, the dip is to the west-northwest or to the east-southeast. The upheaves have generally occurred along both these lines of fracture, giving echelon movements to the masses of strata, so their dip is commonly oblique to the direction of ranges of hills and mountains, and even to the usual line of the emergence of the strata on the surface. The southeast angles of the masses, between the intersecting fractures, are usually elevated, giving mural precipices on the eastern and southern faces of the hills, while the strata dip more or less gradually to the northwest.

The same general principles hold true in the rocks lying lower in the series, as the Hudson slate group, (a part of which are metamorphic,) and the rocks of the Highlands, except that the *southwest angles* of most of the masses of those strata have been highly elevated, giving a high *easterly* dip, and that they have been exposed to a *greater number* of elevatory movements, producing a greater derangement of the stratification.

Most of the streams follow the lines of these two systems of fracture, changing from one to the other to produce many of their changes of direction. I have been enabled to trace some of these lines of fault across mountains and valleys, for many miles.

Metallic veins occur in several places along both these systems of fracture, and it is mostly in consequence of the echelon movements that have occurred in the strata since their first breaking up,* that it is a matter of much practical difficulty to trace out the continuation of metalliferous veins and beds, so as to open them in the most favorable locations.

General and local sections will illustrate these and numerous other interesting and important facts in the final report of the geological survey.

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* There are distinct evidences of at least three elevatory movements, viz: one (at least) before the deposition of the Shawangunk grit strata; another after the deposition of the Shawangunk, Helderberg and Catskill mountain series, and before the tertiary epoch, and another since that period.

The Shawangunk grit rock has been called "mill-stone grit," by Professor Eaton; and it well deserves the name, both from its uses, and its similarity in texture and mineral composition, to the mill-stone grit of England; but as it has a different position, in the geological series, from that rock, which has now become a term indicating a conglomerate grit in a particular geological position, I have thought it better to use a local term for this formation, viz: *Shawangunk grit.*

Economical applications and mines.

The useful applications of the Shawangunk grits are not numerous. They are, for mill-stones, building stones and glass.

The firm, coarse grits, have been long quarried for mill-stones, and have been extensively used. They are known in market by the name of *Esopus mill-stones.** They are still quarried to a small extent, but since the French buhr stone has been brought into common use for mill-stones, the Esopus stones are in less demand. Many *small mill-stones*, for family use, in grinding corn among the planters of the southern States, are still manufactured and sent to market.

The finer white and gray grits, which frequently resemble granular quartz, are well adapted for the manufacture of glass, and it is believed that the glass factory at Ellenville, Ulster county, makes use of this material. I know it was in contemplation to do so at the time of its erection.

These fine grits would make a beautiful and durable building material, which is as easily dressed as the common granites. Localities were seen, within less than two miles of the canal, where blocks could be procured three to five feet thick, and five to twenty feet in their other dimensions, without a seam, and on which the weather has produced no perceptible effect, during the ages through which they have been exposed. Such rock as this, the engineer may use without fear of hazarding his reputation; and his employer may feel certain that the structures built of it will not crumble down by the ordinary action of the weather in a few years, like some of our public works and private dwellings.

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*Esopus was the name of the township and village of Kingston, during the war of the revolution, and as these stones were quarried at no great distance, and were shipped from that vicinity, they have acquired the name of Esopus mill-stones. Esopus is now the name of a township and village a few miles south of Kingston.

It is surprising to see how little attention is paid to the selection of materials for construction. Judging from what has come under my observation, the general impression must be, that *any solid stone may, with equal propriety be put into the walls of buildings.* It is not so, and in our public works and expensive buildings, it is of great importance to select materials that will stand time unchanged. Some granites, limestones, sandstones, marbles and other rocks will stand the vicissitudes of the seasons for ages without any perceptible change ; others nearly similar in appearance and belonging to the same kinds of rocks will crumble to sand or powder in a few years. An experienced eye is necessary to judge whether particular kinds of rock ought to be employed for structures that are intended to be permanent.

Metalliferous veins have been found in several localities in the Shawangunk grits. There are traditions that lead ore has been *cut out* of the Shawangunk mountain in many places by the Indians and hunters of former days, and melted to make their bullets. Traditions of this kind are said to have led to the discovery of the lead ores at Ellenville, Red-Bridge, and Wurtsboro'. Lead ore has been discovered at many other points on the western side of the Shawangunk mountains, and in so many places, that it is thought probable a metalliferous vein may be almost co-extensive in length with this range of mountains in Ulster, Sullivan and Orange counties.

The *Ellenville mine* is within one half mile of that village, at the base of the Shawangunk mountain. The vein is one of the transverse breaks of the strata, and ranges south 60° east nearly vertical. The materials filling the vein are nearly the same as the grit rock that it traverses, more or less loaded with pyrites and crystallized quartz, and in some places with blende and galena. The vein is from two to three feet wide, and a copious spring flows from near its junction with the marsh below. The mine was first opened about twenty years ago, and some lead and zinc ores were obtained, that were reputed to be rich in silver. The lead ore was said to have been more abundant in the marsh than where the "mine" was opened, and it is supposed the Indians and hunters obtained their supplies from the marsh. The "mine" has been worked again within a few years by the North American Coal and Mining Company. It has been said that the adit level penetrated 600 feet into the mountain, but no lead ore of importance seems to have been obtained. I should suppose from the mass of rubbish, that the level cannot have been carried so far ; and again, they would undoubtedly have perforated the grit rock, and entered the subjacent slate rocks, in less than that distance.

It is a fact well ascertained in mining, that metalliferous veins change in productiveness, and sometimes in the kind of ore, as they pass from one kind of rock to another. The grit rock of the Shawangunk mountains is overlaid by limestone,* and underlaid by the slate rocks of the Hudson river group. Both these rocks are, in general, more metalliferous than the grit rocks; hence, the metalliferous veins of the grit, when traced into those rocks, or when the mines shall have been worked through the grit into them, may probably, be more productive. The limestone was not seen in place at Ellenville, but was observed at no great distance, both up and down the valley, parallel to the mountain, dipping in the same direction, and some sink holes, as they appeared to be, left no doubt on my mind, that the limestone ranged along the valley, between the canal and the base of the mountain, covered by alluvial deposits.

The *Ulster mine* near Red-Bridge, and worked by the North American Coal and Mining Company, is situated on the Shawangunk mountain about one mile east of Red-Bridge, and six or seven from Wurtsboro', at an elevation of 600 or 700 feet above the valley. Two or three openings have been made. The first, which I believe is the uppermost one, I saw in 1837. It had been excavated during the preceding season and winter. It was on a line of fault, where the fractured grit rock abutted against the broken, irregular and bent edges of the slate of the Hudson slate group. It seemed as though the slate rock had been elevated, and its edges by rubbing against the face of the grit, had been broken and bent very irregularly. The space between the slate and grit was filled with a silicious gangue containing quartz crystals in great numbers and of large size, more or less interspersed with masses of blende, galena, copper pyrites and common pyrites. In 1838 the company had driven an adit level to intersect the vein at a depth of — feet. This level which intersects the strata of grit rock in a direction nearly perpendicular to their line of bearing, has been executed in the best manner, and is abundantly spacious, not only for drainage, but for taking out the ore on the most extensive scale, should it be found in quantity. Some lead ore has been obtained from this mine, but the quantity is believed not to amount to many tons. Whether this mine will ultimately be a profitable investment of capital, is doubtful; but it is thought that when the vein shall have been followed into the subjacent slate rock, the mine will probably prove more productive than it has thus far. It was intended to re-examine this mine the past autumn, when I could see the results of the explorations of the company for the past season, as it was intimated to me in the spring, that they had determined to expend $10,000 on it this year. As I have not been able to examine it this fall, I hope to do so next season.

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* The limestone does not often cover the grit rock on the sides of this part of the ountains, but ranges along the valley, superposed in geological position.

The *Shawangunk mine,* is located on the Shawangunk mountain, about two miles northeast of the flourishing village of Wurtsboro', in Sullivan county, at an elevation of 600 or 700 feet above the Mamakating valley. The vein, in many places, has the aspect of a bed parallel to the contiguous strata of the grit rock of the mountain, but from a careful examination, it is believed to be a true vein, which, like some of the veins of magnetic iron ore that were examined in Putnam and Orange counties, runs between the strata, and then cuts obliquely across them, without altering its dip in any great degree. The strike of the vein corresponds nearly to that of the grit rock, but its *aggregate dip* is greater. The strata were observed to be more or less broken and bent, where the vein, after passing between them, crossed them obliquely. The grit rock on the mountain near the mine is traversed by small veins of quartz, which is more or less porous from the decomposition of its contained minerals. The vein on which the mine is worked, varies from two to five feet in width, and the larger portion of its mass, as far as it has been explored, is a silicious rock similar to that forming the roof and floor, except that it contains fragments and particles of greenish and blackish slate. The vein-stone is more or less loaded with blende, galena, copper pyrites, iron pyrites and crystallized quartz. The blende and galena constitute probaby $\frac{4}{5}\frac{9}{0}$ of the metalliferous contents of the vein, and these minerals are in general more or less intimately mixed.

The metalliferous part of the vein is from one to three feet thick in some parts, in others it narrows to a thin almost linear seam; in some places the lead ore, in others the zinc ore predominates. The ore, as an aggregate, may be said to lie in bunches, and the productiveness of different parts of the vein is very variable. When examining the mine last spring, three masses of galena, free from other ores and from gangue, were taken out of the mine, weighing about 800, 1,000 and 1,400 pounds. One of these masses is believed to have been sent to the office of the company in New-York.

This mine is said to have been originally discovered by a hunter, and the first opening was made some 40 or 50 feet from the present shaft of the mine. It was worked from the outcrop of the vein to a depth of about thirty feet, and some tons of lead ore, (it is supposed thirty tons,) were taken out of the mine. This opening was abandoned in consequence of the thinning of the metalliferous part of the vein, and the difficulty of raising the ore through an irregular and sloping shaft. A vertical shaft was in process of excavation at the time of my visit in 1837, and it had reached the vein at that time. Lateral galleries have since been driven on the course of the vein. An adit level was driven perpendicular to the strike of the vein through the intervening strata of grit rock, 52 feet* below the mouth of the shaft, so as to intersect the vein at the distance of about 200 feet from the main shaft. Galleries have been excavated laterally on the course of the vein from the extremity of the adit; and the southern one of these has been connected with the shaft. This adit and the contiguous galleries serve as a drainage level for the upper portions of the mine. Another adit level has been driven into the mountain so as to intersect the vein at a perpendicular depth of 75 feet below the other, and the main shaft is continuous from this intersection, sloping up the course of the vein to where this inclined shaft unites with the vertical one, at the upper tier of galleries. Lateral galleries have been excavated on the course of the vein from the sides of the inclined part of the main shaft, and it was in these that the miners were employed at the time of my visit.

The ore is slidden down the inclined shaft to the lower adit level, whence it is removed to the ore heaps opposite this level. It is there picked and washed, and then sent to the smelting-house on the bank of the canal, which, by the winding course of the road is about one, or one and one-fourth miles.

The adit levels of this mine are spacious, and have been well executed, and as the rocks are indestructible, the preparations for working the mine may be considered as permanent improvements to last for ages, if it should be sufficiently productive to continue working it.

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* Vide Prof. Beck's 3d Annual Rep. on Mineralogical Department of the Geol. Survey, p. 49.

There is now a back* with an average depth of perhaps 150 feet on the slope of the vein, ready for removal by the miner, and ready drained, so that if large bodies of ore exist there, they can now be removed without additional expense, except that merely of mining, since all the necessary preliminary expenses have already been incurred.

The advantages of these mines are,

1st. Contiguity to water transportation and nearness of market.
2d. Great depth to which they may be drained without machinery.
3d. Abundance and cheapness of fuel for smelting.

The disadvantages are,

1st. Uncertainty of the quantity of ore.
2d. The more or less intimate mixture of the galena and blende.
3d. The silicious nature of the gangue.

The explorations in progress will demonstrate the probability or improbability of the mines being prospectively productive.

The mixture of the galena and blende offers a practical difficulty in the smelting operation, and various mothods have been tried to effect a separation, so as to be enabled to smelt the ore and obtain the lead; but they have not proved successful up to the present season. At the time of my visit, they were erecting shaking washing tables, which, (if the ore be first crushed or stamped, and then separated into uniform sizes by screens of different degrees of fineness,) it is presumed will be successful.

The process for separating the blende or zinc ore, will also separate the greatest portion of the silicious matter, so that if the shaking washing tables effect the separation, the future value of the mines will depend only on the quantity of ore.

There is a strong probability that there are valuable deposits of lead ore in the Shawangunk mountain, since so much lead ore has been taken from this and other mines, and from its having been found in so many places.

The zinc ore in the Shawangunk mine, as far as it has been worked, is believed to have exceeded the lead ore in quantity. At the time of my visit, they were taking out large quantities of both these ores.

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* The "*back*," in mining phraseology, means the mass of a vein that has not been removed, and lying above the galleries that have been opened.

It is thought probable that the ores may prove more abundant, and richer in lead, when the workings shall have reached the slate rocks that underlie the grit, but as the vein does not dip at a much greater angle than the strata, it is not probable that these rocks would be reached in this mine, without penetrating to at least the level of the valley, or 500 to 700 feet below the present workings.

The lead ore of this mine contains some silver, but I have not ascertained the proportion. I cupelled a few grains of the lead obtained from some of the ore. A small but distinct globule of silver remained. Prof. Beck, of the mineralogical and chemical department of the Geological Survey, has since cupelled some of the ore and obtained silver.* Whether it exists in such quantity as to make its separation a matter of importance is not ascertained.

Pyritous grit.

In some places, the upper strata of the Shawangunk grit, are more or less loaded with pyrites. Occasionally this mineral forms a large portion of the rock, constituting the gangue, in which the pebbles and finer grains of silicious matter are embedded. Boulders of this variety of the grit rock were observed scattered over the country in the counties of Orange and Ulster, southeast of the Shawangunk mountains, and boulders of precisely similar appearance and composition were seen on Long-Island near Sand's-Point, and in other places.

A locality of this pyritous grit was examined south of Rochester, Ulster county, where the rock contained pyrites, and had been reputed to be a *silver mine.* A small excavation had been made. The only use to which it could be applied would be the manufacture of copperas; but it is not sufficiently abundant there to warrant any expenditure. This locality is near the base of the Shawangunk mountain, and one fourth of a mile south of the Mule kill, in the township of Rochester.

Red rock of the Shawangunk group.

A stratum of red rock has been mentioned as lying on the top of the Shawangunk grit. It is observed covering it in several places, but it is usually thin, and varies in texture from a compact hard red grit, to a red crumbling shale. The former may be seen in crossing the mountain between Bloomingburgh and Wurtsboro, about one fourth of the distance up the mountain on its western side. It may also be seen in several places between this locality and the New-Jersey line.

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* Vide Assembly Document No. 275, for 1839, p. 51.

On the road between the Shawangunk lead mine, and the smelting house, the red rock is seen as a crumbling slaty sandstone of a chocolate colour.

At the High falls of the Roundout, in Marbletown, Ulster county, the red rock is a shale and fine slaty grit, spotted with green, and interlaminated with thin bands of limestone. It is there covered by the water-lime series of the Helderberg limestone group.

South of Rochester, Ulster county, near the locality of pyritous grit mentioned above, is a red shale passing into a red clay* by exposure to the weather. It covers the white rock in patches in this vicinity. The grit rock is here waved in gentle swells, along axes of elevation which are subordinate to the two main axes of the Shawangunk mountains.† It is thought probable that beds of iron ore may be found in connection with this rock, which is highly ferruginous and frequently pyritiferous. Iron ore abounds in some parts of Pennsylvania and New-York in a similar geological position.

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* The clay beds and loams of maay parts of the valley of the Rondout, and of this part in particular, are reddish, as is supposed from the intermixture of the materials derived from the "red rock."

† The fact of two great systems of fracture in our rocks, which approach to regularity of direction within comparatively narrow limits, and that the southerly ends of masses of strata are almost constantly elevated along the traverse lines of fault, while the proper axes of elevation follow the other or longitudinal lines of fracture, has already been adverted to. The results of these combined elevations, are echelon movements of the strata to a greater or less extent. The successive ridges sink gradually to the northeast, until they disappear, while they are frequently succeeded by other ridges, which are not in the exact lines of prolongation of the former, but obliquely lateral to them. These in turn sink, and so on. If the faults are numerous, a serrated or broken outline is given to the ridges. The Shawangunk mountains are less broken than any others with which I am acquainted, and which have been upheaved along an axis of elevation; bnt several breaks may be observed in them. These mountains continue with but slight breaks, from the New-Jersey line near Carpenter's-Point, to opposite Ellenville and Wawarsing, in Ulster county, where this ridge is crossed, by great breaks and faults. The ridge then sinks and rapidly disappears beneath the valley, while several subordinate parallel axes of elevation spring up on the east at about the same height, run northeastward between the Stony kill, Mule kill, Sanders kill, &c, sink down gradually towards the mouths of those streams, and finally disappear below the valley in Rochester and Marbletown, or show their continuation only by low broken ridges of upheaved limestone. These axes of elevation are terminated, apparently, on the south, by the high cliffs along the transverse lines of fault.

I. HUDSON SLATE GROUP.

This group consists of a series of slates, shales, grits, and limestones, with silicious and calcareous breccias, and hypogene and plutonic rocks.

Some of the grits, or graywackes as they have been called, of this group, are used as building stone, and some of them are well adapted for such uses. They are easily quarried and come out with smooth faces along the joints of the rocks.

Coal has been sought in many places in the Hudson slate group, in consequence of the blackness of many of the beds of slate and shale, and because thin laminæ, and small masses of anthracite have been found. There are such localities in Marlborough, New-Paltz, Plattekill and Marbletown, in Ulster county; and Coxsackie, in Greene county, where excavations have been made, and high expectations of the value and productiveness of the mines entertained. It is perhaps superfluous to add, that no valuable quantity of coal has been found, or *will*, probably be found in this group of rocks.

A *sulphur spring* occurs on the land of Mr. J. Hasbrouck, about one mile west of Springtown, in the township of New-Paltz, Ulster county. It rises from the alluvial gravel over the slate rock in the bed of a small brook, and it is believed that if the brook should be excluded, the water would be strongly hepatic, and might be applied medicinally to the cure of such diseases as are benefited by hepatic waters. Gas rises in bubbles at intervals of a few seconds from the bottom of the spring. The spring is near the base of the Shawangunk mountain, and nearly opposite Buntico Point.*

On the east of these minor axes, the second main axis of elevation takes its rise from High Point, which is a high cliff of grit rock on the main fault, and ranges thence northeastward, more or less broken and dislocated by minor transverse and oblique faults, and diminishing in height, until the Shawangunk mountain, and its grits, which envelope most of the higher parts, entirely disappear below the limestones and tertiary deposits at and near Rosendale. Several high points with mural fronts and ends, are seen between High-Point and Springtown, as Sam's-Point, Great Mogunk, Buntico-Point, &c. all of which are caused by faults along the main fractures of the mountain.

* Buntico-Point is a high point or precipice on the Shawangunk mountain, and is one of the old landmarks of the county, as well as most of the other high points of those mountains to which lines were run in laying out the " Patents." Buntico, in the language of the aborigines, is said to mean a spotted cow, and Buntico-Point took its name from its having been one of the landmarks of a tract of land purchased of the Indians in exchange for a spotted cow. Messrs. Van Wagenen, of New-Paltz, and J. Hasbrouck, of Springtown, gave me much local information relative to the objects of the survey.

A sulphur spring is said to occur near the Katerskill, two miles west of Catskill village, on Henry Palmer's farm, and with gas bubbling up through the water. Another sulphur spring, a mile from the above, on the other side of the creek, on Peter Acler's farm. Another mineral spring in the township of Esopus, and not far from the village. I did not see the three last mentioned springs.

The range of limestone described in the second annual report under the name of Barnegat limestone, and in the third report under the name of Newburgh limestone, occupies a small area in the district under examination this year. A hundred acres or more of this rock may be seen in the southeast corner of the township of Marlborough, in Ulster county. On the north-northeast it crosses the Hudson and ranges through Dutchess and Columbia counties, while on the south-southwest it ranges across Orange county. In Marlborough it has been used some for lime, but to no great extent. These lands will ultimately become valuable. The general dip of the limestone, is the same as the adjacent slate rocks, viz: east-southeast from 20° to 70°.

But few fossils have been found in the Hudson slate group this year. A few fossil shells, or rather the impressions, were found in the thick beds of graywacke, which contained drusy quartz and small broken fragments of anthracite, on the right bank of the Wallkill, by the road side, a few rods above the falls at Dashville, in New-Paltz, Ulster county. The other fossil remains were fucoides, among which are F. serra, F. dentatus, and two other species which are probably F. lineatus, and F. ramulosus. These fucoides or graptolites were in the black shale underlaying the Shawangunk grit, on the mountain about 1½ miles east of Ellenville, at the height of 500 to 700 feet above the valley.

The Hudson slate group corresponds in many respects with the "Cambrian system" of Professor Sedgwick, to which it may be a geological equivalent. It occupies most of the country between the Highlands on the southeast, and the Shawangunk mountains on the northwest, and forms the mass of the latter mountains which are capped, and in some places enveloped by the Shawangunk grit. From Kingston, the Hudson slate group ranges along the right or western bank of the Hudson to Albany, underlaying the superincumbent rocks unconformably, with few exceptions. Its range on the left bank of the Hudson, as far as examined, is detailed in the second annual report on the geological survey of the first district of New-York.

The particular description of this series will be delayed until the final Report, when the whole of these rocks within the limits of the State shall have been examined.

The specimens collected this year and which are not very numerous in consequence of the slight variations in aspect over extensive areas, have been placed in the cases in the Capitol.

W. W. MATHER, *State Geologist.*

FOURTH ANNUAL REPORT

Of E. Emmons, of the Survey of the Second Geological District.

To his Excellency William H. Seward,
Governor of the State of New-York:

Sir :—The prosecution of the Geological survey has proceeded during the past year without interruption. My regular assistant and myself were in the field during the period of six months, which is about the medium term in which field duties can be prosecuted to advantage. Our labors have been principally directed to the valuable ores of iron and lead, in which the Second Geological District is known to abound. There are important reasons for giving an undivided attention to those mineral deposits. Their geological position requires an exact determination. The indications of their presence demand a full investigation, in order that a system of rules may be formed by which the miner may judge of the presence, or absence of any given mineral production in a given formation. Besides these economical considerations, there are others which relate to the science in general, and which are promoted by exact and particular observations on the accumulation of mineral matter in general. The idea that cursory observations are sufficient to establish rational hypotheses or to develop a system of formations, is not admitted at the present day ; but on the contrary, it is required that every fact should be collected which bears even remotely on the subject. In this method only, may we hope to advance geology, and remove those uncertainties which belong to it and place it on a foundation less empyrical than it rests at present. The consideration that exact observations are of the highest importance in geology, is fully supported by the measures which both the governments of England and France have instituted to secure minutely accurate geological surveys in their respective kingdoms.

England has yet in progress the ordnance geological survey, which is under the able direction of H. T. De La Beche, F. R. S. from whom we have an important report, in a volume of 648 pages, which has been made during the last year. It embraces a very detailed account of the geology of Cornwall, Devonshire and West Somerset, and is accompanied with numerous coloured maps and sections. It is worthy of notice that the district on which the labors of De La Beche have been expended, is one which has already received the attention of almost all the distinguished geologists of that country. Still the government in consideration of the importance of the subject, is urging forward the accomplishment of a new and thorough survey, as rapidly as is consistent with perfect accuracy.

France too, prior to 1833, had ordered a geological map of the whole kingdom, and which has been executed by M. M. Elie de Beaumont and Dufrénoy. These facts are stated, that it may be more generally known that government surveys of this kind are not confined to this country; and also, that it may be known in what light works of this kind are viewed in Europe.

Individuals in their private capacity, and at their own expense, may and do accomplish much, and the country ought to have them in esteem as promoters of the public welfare. Yet it cannot ro ought not to be expected that individuals can accomplish for a long period to come, surveys of this country. In the mean time much would be lost in various ways, if left to individual exertion, for want of exact knowledge in this department of science; and in particular, much would be expended in speculations in a business, the principles of which are but little known, and but imperfectly established. The expression of these views, I am sensible is unimportant to the enlightened body before whom they are to be laid; yet they may assist in sustaining a policy which may not be so well understood by those whose means of information is, for any cause, deficient.

In this report I shall speak of the subjects in nearly the order in which they were investigated in the field. I shall, therefore, in the first place invite your attention to the *iron ores* of Essex and Clinton counties. I shall describe each collection of ore under the name by which it is known in its immediate vicinity. It is not my intention to be very minute in my details at this time: those considerations which are of a general nature, it is deemed are more suitable to an annual report.

SECTION I.

1. *General considerations.*

The iron ores of Clinton county being the first in the order to be noticed, belong mostly to granite which varies somewhat in its character, if the whole district in which these ores occur, is considered.

The ore is the magnetic oxide, generally black in the mass and streak. The exceptions to these characters will be noticed when I come to speak of individual deposits. The ore occurs in veins which traverse the rock in directions varying but little from north and south. The general direction of the strike of the rock, is northeast and southwest. The veins as would be expected, cut the strata at a small angle both in the prolongation north or south, and also in their direction downwards. If the relations of the ore to the rock are, as they are now stated, there is no difficulty in conceiving it to occur in veins. More conclusive evidence, however, will be furnished on this point, when we speak of the individual veins, where alone all the parts may be so stated, as to save repetition. It is perhaps needless to say, that they have been considered as beds, a decision which was probably made by considering that there was a parallelism between the prolongation of the ore and the layers composing the rock. There is, it is true, but little difference in the bearing of the rocks and of the veins; but yet, careful inspection, and especially measurement, show that parallelism does not exist, unless in very limited distances.

ARNOLD VEINS.

No vein of iron ore has acquired so much celebrity as this. It furnishes an ore easy to reduce; forms a soft, tough iron, and which is rapidly produced in the common forge. Bloomers are always satisfied if they can be furnished with this ore, for the above reasons; to which may be added, that in consequence of its purity, it does not require washing or separation. For these reasons too, it has been explored deeper and more extensively than any other mine in the northern counties.

It acquired a high reputation soon after it was discovered, and was leased to the Peru Iron Company for ten years, at a rent of $6,000 per annum.

There are 3 parallel veins, which are known as the Arnold ore. The 1st is the old blue vein; 2d, the gray; and 3d, the black. The first is the most valuable in the estimation of bloomers, and for which a preference is always expressed. The colour is a light blue, and it is destitute mostly of a metallic lustre. It is more or less granular and soft, and unlike the ore of this mineralogical species, it gives a red streak, thereby indicating that it has undergone an important change in regard to the degree of oxidation of the ore, and is at the maximum state. The facility with which the ore works is to be attributed mostly to the presence of silex, or quartz, finely disseminated through the ore in the proper proportion for forming a flux. There is no excess of stony or earthy matter on which the heat and other agents in reduction requires to be expended. This vein has been worked to the depth of two hundred feet, and about fifty rods in length. Its width varies from 2 to 8 feet. This variation of width is not an uncommon circumstance. Its medium width is not far from 4 feet.

In its descent it dips at an angle of about 75° or 80° to the west. This vein was necessarily abandoned a few years since in consequence of the caving in of the western side. The removal of ore to the depth of 200 feet brought the pressure of the rock and earth on the western side, which it was unable to support on account of the dip. About six rods in width of rock and earth fell towards the east about three feet, thus nearly closing up the space which had existed between the walls. The timbers which were placed lengthwise against the walls, were crushed, though they were so numerous that it was impossible for a man to get about between them. This vein is now recovered by the enterprise of the present proprietor, Col. Barton. It was recovered by ascertaining correctly, the direction of its strike towards the north, and excavating through the gravel and boulders, down to the rock. The first attempt was successful, and it shows the value of geological principles in recovering a lost vein.

2. *Quality of the Iron.*

The iron produced from this ore is remarkable for the following properties ; toughness and softness combined with great malleability and tenacity. The possession of these properties have been determined by a series of experiments, under the direction of government, for the purpose of ascertaining the strength and value of the iron for cables. Cables were formerly made by the Peru Company. These, though they possessed the requisite tenacity, yet the company could not compete successfully in market with English cable, and the manufacture of them was consequently abandoned. This iron too, was acted on more by sea water than the harder kinds of iron, and hence there arose another objection to the cables made from the Arnold ore.

It is evident too, that for horse shoes and other purposes where it is exposed to wear, it is not so valuable; this objection is obviated, however, by mixing harder ores with it, by which there is formed an iron possessing both hardness and tenacity.

3. *Other veins of the Arnold Hill.*

Lying side by side with the blue vein is a gray and black vein. They are separated by only a few feet of rock, and though they are distinguished by distinct names, yet there is in fact but little difference in the appearance of the ore. Each vein furnishes much that is blue and similar in appearance to the blue vein. Taking, however, either vein as a whole, there is sufficient difference in the eyes of a miner, for the distinctions already referred to. The quality of the ore too, is similar to the blue vein, being soft, granular and easily wrought. They furnish iron also of the same general qualities. If any difference exists, it is in hardness, which however, is only slightly increased. The same facts too, exist in relation to dip, direction and depth to which they have been worked. The width of the *black vein* is from 3 to 11 feet wide, and the *gray* is from 2 to 8 feet. In pursuing these veins downwards there is no decrease in width. At the surface they pursue parallel courses, but it is possible that they may constitute but one vein in the interior of the earth.

The three veins are crossed and cut through by a green stone dyke, which is about 10 feet wide. In its passage across them it produces no change in the direction of the blue and gray veins, but the north side of the black vein is moved four feet towards the east.

Another vein which was early discovered on the Arnold hill, is one which is called the Indian vein. It appears some fifty rods to the west of the veins just described, and passes in a direction oblique to the others, so that it intersects them some distance north of the present workings of the blue and black veins.

It is a harder ore and has not been wrought to sufficient extent to determine its real value. The iron however which was made from it is said to have been excellent, though it worked harder than the neighboring ores, on which account it has not been explored. This vein furnishes an additional reason for the opinion which has been expressed in favor of considering the collections of ores, as veins instead of beds. The Indian vein is a perfect example of a vein, which no one would think of calling a bed; besides there are distinct walls in each case bounding the mass of iron on the east and west sides.

The rock containing these ores is a red granite, the colour of which may be owing to the dissemination of the oxide of iron. The changes in the ores also is generally stained with the peroxide of iron, the presence of which is always taken as an indication of the goodness of an ore.

4. *Associated Minerals.*

Fluor spar in small green, also occasionally in purple masses, occurs sparingly in the gangue of the ore. Calcareous spar in opake masses forms a large proportion of the gangue. The arrangement of the mineral matter constituting the vein is in alternating layers, an arrangement which is not easily described without the aid of a diagram.

PALMER VIEN.

The history of the working of this vein is interesting on account of the difficulties which have been experienced in finding the main vein. It has been explored for many years and has furnished a large amount of ore, but the principal vein was not opened till this last year.

The difficulty of finding the true vein, has been owing to four distinct dykes which cross the vein in as many directions. One of these is fourteen feet wide, and may be traced on the surface for the distance of half a mile. Its strike is in a direction nearly parallel to the vein, but still sufficiently oblique to it to cut it at a small angle at the place where it is opened to the greatest depth and width. Upon the east side of this dyke there were several places where ore occurred, and in some points large masses had been exposed and removed. These masses however were generally rather lean, and finally became unprofitable, and of course were abandoned. By the perseverance and well directed efforts of Mr. Burt, the manager of the Peru Iron Company's works, the main vein was discovered. This fortunate result was effected by piercing the fourteen foot dyke, on the west side of which, a vein thirty-five feet in width was discovered. The ore is black and mixed with white flint. It contains too much earthy matter to be smelted without washing. It is therefore less pure than the Arnold veins. It loses about one-third of its weight by this operation.

The relative position of the dykes spoken of, cannot be understood without the aid of a diagram. I shall not therefore attempt to convey an idea of their position.

The rock embracing this vein is gneiss of the ordinary gray colour, and without any remarkable characters.

5. *Quality of the Palmer ore.*

Experience has proved the value of Palmer ore, and it is regarded as one easy to reduce, and as furnishing a valuable iron. It is a harder ore and produces a harder iron than the Arnold vein. It is therefore used with the latter for the purpose of increasing the hardness of this product. It is not so rich in the vein, and is mixed, as has been remarked, with white flint in too large a proportion to be reduced without washing. It will be inferred that it is preferable to the Arnold ore for some purposes, such as bands for cart wheels, horse shoes, and horse nails, and for all purposes where an elastic iron is required.

6. *Probable quantity.*

If the opinion is correct, that in piercing the fourteen foot dyke the main vein was reached, then, there can be no doubt, that the quantity of ore is inexhaustible. This portion measured from southeast to northwest was found to be thirty-five feet wide. The eastern wall of this vein is formed by this dyke, from which the ore cleaves, leaving a smooth naked surface. The opposite wall is formed by the main rock, and is more or less irregular and uneven. The vein dips to the west, but the amount of dip could not be ascertained in consequence of the feeble light and the small surface exposed on its western side. The interesting relations of this vein to the main rock, and to the dykes which traverse it, cannot be well understood or explained without the aid of diagrams.

The vein and its accompanying dykes furnish one of the most interesting and instructive examples of the effects of intruded rocks, and of subterranean force in producing derangements, known in the northern section, a particular account of which, will be given in the final report.

COOK VEIN.

The Cook vein traverses a hill 3 miles northwest from Clintonville. The Peru Iron Company have, in former times, worked a vein cutting through this same hill, which is only two feet in its greatest width. By the side of this vein, and only 4 or 5 feet to the west, another parallel vein existed, which is thirteen feet wide, but remained undiscovered till about a year since, when it was brought to light by making a cross cut, a mode of opening, which ought always to be pursued; inasmuch, as simply following a vein in the direction of its length, cannot lead to farther discoveries, as is proved by the experience of the Peru Company in working the narrow vein, to which, allusion has already been made. By opening a vein in a direction perpendicular to its strike, or in other words, across its course, there is a better opportunity to ascertain the nature of its contents, the width of the vein, and advantages are secured for raising ore, together with a chance of discovering additional veins; the instances are very common for two or more parallel veins to exist in immediate proximity. It is too, the only method by which a lost vein can be recovered. It may be therefore considered as an established rule, the importance of which is supported by experience in all mining countries, that veins are to be opened by cutting across them and not by sinking perpendicular shafts, or shafts passing in the direction of the dip.

The ore of the Cook vein is black, some parts of the vein is granular or soft, as this slate is usually called by miners, other portions are compact or in firm masses. It is a rich vein even near the surface, and it improved as the excavation proceeded downwards. It is not however so pure in the vein as to admit of smelting previous to washing. Its gangue is quartz or flint, black mica and hornblende. Its supporting rock is granite. The course of the vein is north and south. Parallel with the thirteen foot vein which is to be considered as the main vein, are three others, one of six, one of three and another of two feet. The hill on which these veins are found is two hundred feet above the plain. Its location is therefore quite favorable for mining operations, as it will be for a long time easy to drain, and convenient for removing the ore.

7. *Quality of the iron.*

The iron made from this ore is of the first quality. Along with hardness, there is sufficient elasticity and toughness to make it valuable for spikes, horse shoes, bands and nails. The grain is fine and bright with a clear metallic lustre; it hammers very smoothly, and presents a very fine even compact surface. In fine it resembles very nearly the old Russia sable, so celebrated in this country. The ore makes iron fast, and considering all its properties, it must be considered one of the most valuable veins in the county of Clinton.

8. *Quantity.*

In estimating the quantity of ore which the Cook vein may yield, it is proper to take into the account the four parallel veins. It will be seen that their aggregate width is twenty-four feet. Those several veins are so near each other that by transverse cuttings, all of them may be worked as one vein. The examination of the vein proved also the increase of ore downwards, an increase produced in part by an increase of the width of the vein, and also by the disappearance of the stony matter in the vein. The arrangement of the ore and earthy matter is mostly in vertical parallel bands or stripes. It is evident in many instances that there is a larger amount of rock in the vein near the surface. This was evidently the case with the Cook vein, though it would not be an uncommon circumstance if the predominance of earthy matter should be found restored deeper in the vein. Still the indications were favorable to an increase of ore, rather than a diminution of it.

The Cook vein may be traced in a northerly direction by the masses of ore at the surface of the rock, for one and a half miles. At its extreme northerly boundary it appears again in heavy masses, and has there been opened by Mr. Stone, and is now successfully and profitably worked. The ore of this vein is highly magnetic and possesses distinctly, polarity. This is a property, however, which is more frequently possessed by that portion of the vein above the surface of the rock, or that portion which has been exposed to light. It often happens that ore which is raised from a depth of 25 or 30 feet, exhibits at first neither polarity nor magnetism, but after exposure to light and atmospheric agents, this property is strongly developed, indicating it would seem, some connexion with imponderables, as light, caloric and electricity at the surface, which does not exist far beneath it.

From what has been said, it will be seen that the quantity of ore which the Cook vein is capable of furnishing, is all that can be wished. Its breadth and prolongation northwards show conclusively that for a long time it will be accessible without deep excavation.

This consideration I have thought proper to introduce, inasmuch as it bears on the permanence and stability of the manufacture of iron, and the expediency of permanent improvements. If the veins of ore in a given section of country are soon to be exhausted, then there is no occasion or no propriety in making extra expenditures to facilitate the transportation of heavy articles. On the contrary, if these collections of ore are inexhaustible, then they constitute a permanent source of wealth and income to the country, and which may be increased by facilities for transportation, without danger of finally losing value from want of articles to transport.

BALTIC ORE.

The Baltic vein is to be considered as a part of the Cook vein. It is distant from the latter one and a half miles, and from which it may be traced by surface ore. The vein has been exposed in two places; the most southerly was mixed largely with iron pyrites, especially the portion adjacent to the eastern wall. It is not so highly charged as to prevent its use in the furnace; but for bar iron it proves brittle. On account of the injurious mixture of pyrites in the southerly opening, the vein was sought for twenty or twenty-five rods further north, when it was found to be well developed near the surface. This last opening was just made at the time of my examination, and the true character of the vein could not be determined. Still, there was a width of thirteen or fourteen feet of vein, mixed with rock composed of flint, hornblende and black mica. Thick solid masses of ore, free from pyrites, were found traversing the vein longitudinally, somewhat wedge-form in shape, with the thicker portion downward, indicating an increase of ore in that direction, and the disappearance of rock from the vein. It is proved by reduction, to make an iron similar to that made from the Cook ore; ore, as has already been stated, as of the best quality.

About fifteen rods farther west, is another vein of iron, with a gangue of pure white flint, which I examined, and which may be traced thirty or forty rods. The ore is black, and constitutes about one-third of the vein at the surface. By the encouragements which were given, this vein has also been opened, and presents favorable indications of being a valuable deposit of ore. The presence of white flint is always regarded as an important substance in the magnetic oxide, particularly as it becomes a valuable flux in the process of reduction.

This vein varied from four to six feet in width at the surface; and I am informed since my visit, that not only the quantity of ore increased in the vein, but also increased in width.

RUTGERS VEIN.

This vein is eight miles west from Clintonville, and like most of the veins in this vicinity, occupies a ridge of one of the primary ranges. It has not been explored to a great extent. Its appearance is loam at the surface, but no more so than many veins which by farther pursuit, have proved to furnish an abundance of ore. The gangue or mineral matter associated with the ore, is very peculiar; and so far as appearance and some of its physical characters may be relied upon, is a new mineral substance. Its characteristics have not been sufficiently tested to determine this point.

The whole width of the Rutgers vein is about ten feet. It pursues a parallel course with the Cook and Arnold veins, and has been traced about one mile. It is probably an extensive vein. It has not furnished an iron so valuable as most of the other ores; it has therefore been abandoned.

WINTER ORE.

This ore has generally been considered to be deposited in the form of a bed, in consequence of its appearing as thick plate overspreading several square rods of the rock with which it is associated; or it appears as though it was deposited horizontally on the rock, like an overflowing melted mass of lava. The opinion that it is a bed is questionable, inasmuch as it presents no phenomena really distinct from the ordinary veins of this section of country. The rich layer of ore was 2 or 3 feet thick. The ore does not disappear beneath, but it is underlaid by a very lean mass in which the particles of ore are disseminated. The whole amount of valuable ore extended forty feet in one direction, and one hundred in another. The whole of this mass has been removed, and the surface now exposed presents an unequal distribution of ore, but in no place an amount worth the expense of raising. It presents, however, the same general arrangement of ore as all the veins, that of parallel bands or stripes. In some portions the ore is in the proportion of one half, the other half being white flint. Considered as a vein, its strike or course is west of north, and its dip, west. Ten or fifteen feet beneath the solid plate of ore, a passage has been made in the solid rock for at least one hundred feet. It commences on the northern slope and runs nearly south. No ore was discovered by this procedure, and it could not have been reached, even if there is an abundance of ore, in consequence of the dip of the vein; the entrance into the rock being made on the eastern side of the vein to which its course is parallel.

The great difficulty of obtaining ore at this place, is in consequence of the great derangement produced by transverse dykes. In the distance of one hundred feet on the line of the ore, there are nine dykes. Without occupying time and space in describing the vein or its derangements, it is sufficient to say, that so long as there are other deposits of ore more accessible than this, it is not likely to receive any farther exploration. There may be an abundance of ore, still stronger inducements must exist before it can be explored by men of ordinary judgment and prudence.

MACE VEIN.

This is a vein which is newly discovered, and has not yet been opened to an extent which admits of a thorough examination. At the surface it is well characterized, and is four feet wide. The width has increased since it has been worked. It pursues the same northerly direction as the other beds, and its dip is to the west. It may be traced by the masses of ore in the rock, twenty-five or thirty rods. The ore being rich in the vein and associated with flint, furnishes good evidence of a valuable vein. It is about two miles east from Clintonville, and is easy of access. It furnishes a valuable addition to the stock of ores in this vicinity.

BURT VEIN.

This is a hard ore and requires only a passing notice. In our trial with the ore, it was reduced easily, but when put under the forge hammer, the loop broke in many pieces. These were again put into the fire and came out good iron. The ore is fine grained, with a strong metallic lustre. It is tough and contains much sulphuret of iron. Still, those unaccustomed to the busines of smelting ores, would consider it as one of the most valuable of this species. Generally, those ores which have a bright lustre and are tough or difficult to break, are to be ranked among the poorest of ores; while those with dull lustre, accompanied with friability, are as generally good.

The Burt vein is eight feet wide, or rather the associated mineral, which is feldspar, is eight feet, in which the ore is disseminated in it in masses of several pounds weight. Its direction is east and west.

JACKSON VEIN.

This vein I consider a continuation of the Arnold ore, as it is in the direction of its course, and on a hill of the same elevation, and only a mile or a mile and a half distant. The vein is quite distinct, but was not opened its entire width. The quality of the ore is unquestionably good, and there is no doubt of their being an abundance.

FINCH VEIN.

This is the southern prolongation of the Arnold vein. It has furnished a large amount of ore for the forges in the vicinity of Clintonville. The character of the ore is much the same as the gray and black veins of Arnold hill. It is not worked at the present time.

McINTYRE VEIN.

This vein, though situated on the same hill as the Palmer ore, cannot be considered as a part of this vein. It is on the south face of the hill, and has a course about northwest. It is a new vein, and has been explored to a small extent only; but from its appearance, the indications for a valuable ore, and abundance of it, could hardly be doubted. It has a width of from six to ten feet. Many parts of it, as now exposed, are the soft granular variety. So far as I observed, sulphuret of iron is not present in the ore. It is associated with black mica, hornblende and quartz. For reduction, it requires either separation of the earthy matter by working, or the magnetic machine.

9. *Entire width of the veins, in the Clintonville District.*

The preceding account of the iron ores, in the vicinity of Clintonville, is drawn from facts and observations which were made during the last season. I have not spoken of those which I did not visit. It appears from the facts now presented, that there is a width of vein of at least 136 feet, after excluding the Burt and Winter veins. Several of these veins have not been explored to a depth which furnishes the best ore, either as it regards purity in the vein, or freedom from earthy matter. As the veins are worked, they become more valuable. It will be understood, that the veins described, occur in the vicinity of Clintonville, and within eight miles of the village. It is a mineral district.

It must be confessed, however, that in consequence of the consumption of wood, that the prospect for the future is not so cheering to the enterprising manufacturer of iron, as could be wished. Unless means of communication are furnished to the wooded districts of the Saranac and Upper Au Sable, the present highly flourishing establishments for the manufacture of iron, must in time be abandoned, and, as it would appear, at a period when the demand for it will be greater, and when every attending circumstance will be favorable to the production of a better material, at a diminished cost.

The amount of ore is inexhaustible, and it is quite accessible. Its value at the mine, after it is raised and dressed, varies from 4 to 6 dollars. The establishments for this manufacture are increasing. Though they are generally small, still they are profitable; and could the forest at the western boundary of the county, become more accessible, it would be all that is required to give perpetuity to the present establishments, and also encourage many more, all of which could not fail of making this district one of the most flourishing in the State.

The following account of the iron ores of Newcomb, was prepared by the request of the proprietors, and furnished in advance of the annual report. At the first view, it may appear that it contains matter too local to be admitted into the annual report. So it appeared to the writer at first, yet, after some reflection and examination, I saw and found that it all related to the resources in which there is a general interest. That which relates, for instance, to water-power, wood, &c. is important to be known, because the value of the mineral deposits depend greatly on their character and quantity. I have therefore retained the report in form and substance, as prepared for the proprietors of this section of the country. I have also retained the letter of your Excellency, addressed to me, at the time specified.

To A. McINTYRE, D. HENDERSON and A. ROBERTSON, Esqs:

GENTLEMEN:

It gives me pleasure to inform you that his Excellency, Wm. H. Seward, has no objection to the publication of that portion of the geological report which relates to the iron ores of Newcomb, in advance of the full annual report to the Legislature, for February, 1840.

You will learn the liberality of Governor Seward's views on this subject by the subjoined letter.

Very respectfully yours,
E. EMMONS.

Auburn, June 14, 1839.

Dear Sir :

I have just received your letter of the 5th inst. I see no objection to your furnishing Mr. McIntyre and his associates the information mentioned, if you can do it without material diversion from the duties of the geological survey. Nor does it seem to me important that they shall be restricted to the publicity they may desire to make of the facts to be obtained by them from you. The greatest public good will result from the widest dissemination of the knowledge acquired by the survey.

I am very respectfully,
Your obedient servant,
WM. H. SEWARD.

To E. Emmons, Esq. at Clintonville.

ORES OF NEWCOMB.

The following account of the iron ores in the town of Newcomb, Essex county, New-York, the author has made as full as time and circumstances would permit. In the preparation of it, it has been thought proper to introduce a few general considerations relative to the geology of this section of country, embracing in them those theoretical views which are intimately connected with practical points in reference to these deposits. Without some doctrinal statements of this kind, the report would be incomplete in itself, and less useful to those persons for whom it is intended.

It may be thought by some, that too much minuteness of detail has been observed in the description of individual veins, and that the whole, or all that is essential, might have been embraced in one general account with equal advantage, and thereby have avoided disagreeable repetition. This course, it is true, might have been adopted, and the report would have presented a more compact form ; still, a full account of each vein seemed necessary and important to a correct understanding of the whole subject. Besides, the reader will be enabled to appreciate the value and amount of those rich repositories of ore, and the peculiar advantages which this section of country offers, for the manufacture of iron, above all others at present known. In this last assertion it may be thought that the writer hazards much, and that he jeopardizes what little reputation he may have acquired as a geologist, or by it subjecting himself to the charge of misunderstanding the peculiar requisites of a manufacturing establishment of this kind. In justification of the remark, I observe, that it is made after a careful examination, not only of this section of country, but of many others celebrated for the manufacture of iron; and that I have spent a portion of three successive years in this work, and each examination has but confirmed opinions which were early expressed, and which will be found in the first annual report to the Legislature of New-York. The writer, therefore, has no fear that it will be proved hereafter that he has misunderstood his subject, and overrated the resources of the region under consideration; and he has, moreover, no doubt but that events will prove, that he might have justly given a greater latitude to his observations, and still been found nearer the truth, and nearer what will be realized in the future operations of this branch of business, as it will be conducted at the McIntyre establishment.

Before I proceed to a detailed account of the veins of ore at Newcomb, (or as it is now more generally called, the village of McIntyre,) I shall present some general considerations in relation to the species and varieties of ore, and its mode of occurrence.

SECTION I.

The Species of Ore, and the varieties into which it is divided by miners.

Mineralogically considered, the ore which is the subject of this report is the octahedral iron ore of Prof. Jamison. It is sometimes denominated the oxidulated iron ore, but more commonly the *magnetic oxide,* in consequence of its obedience to the magnet. Colour, usually iron black; lustre, more or less metallic; streak, black; opaque; brittle; hardness=5.5 to 6.5; specific gravity=5.09; cleavage, parallel to the planes of a regular octahedron. Structure usually crystalline, but its occurrence under a regular form is quite rare in any of the veins in the northern counties of New-York. In fact, in an examination of more than twenty veins, but one crystal has fallen under my notice. There are a few instances, in which the coarse crystalline varieties admit of cleavage parallel to the planes of the primary form. Its occurrence there is in a granular form, varying from fine to coarse, or rather from a compact form, in which the individuals are imperceptible, to those which are quite large and cleavable.

These are the varieties, also, which are recognized by the miner' though he distinguishes them by different names, viz. the *hard* and *soft*. The hard variety includes those ores which are more or less compact, shining and difficult to break, or those which mineralogists call tough instead of hard. The soft are the granular kinds, which may be broken readily with the hammer, and passing from the moderately tough, to those kinds which are easily broken in the hands, and fall into grains. The latter is generally known as the shot ore, from the resemblance which the grains have to shot. This last is most generally an excellent variety of ore, and works easily in the forge; it furnishes, also, a softer iron than the tougher ores.

SECTION II.

Chemical Characters.

The magnetic oxide is a compound of the *protoxide* and *peroxide of iron*, in proportion of 31 per cent of the former to 69 of the latter. Before the blow-pipe, it is infusible per se, but when exposed to an intense heat, it assumes a brown colour and loses its magnetism. It dissolves in warm muriatic, but not in nitric acid.

SECTION III.

Geological Relation of the Species.

In the United States, the magnetic oxide occurs in *talcose, mica* and *chlorite* slates; both in disseminated crystals of the octahedral form, and in veins and insulated masses, more or less extensive. It also occurs in *gniess, granite* and *hypersthene rock.* In the latter, the veins are thick and heavy. So far as observation has been made, this species is confined to rocks of the *primary class.* The largest masses have been found in connexion with that variety of granite which is denominated hypersthene rock in the New-York Geological Reports. In this country, it occurs in less quantity in chlorate slate than either of the other rocks which have been mentioned.

SECTION IV.

Localities.

The wide distribution of the species in the United States, renders it inexpedient to mention all the known places at which it has been found.

In the State of New-York, it is sufficient to refer the reader to the geological reports, particularly those of Professors Beck, Mather and Hall. The species occurs abundantly in the primary parts of New-England, but never in wide or extensive veins or beds. Upon the whole, it may be considered as one of the most widely distributed minerals known, and the most common form under which the iron ore occurs.

SECTION V.

Question relative to the nature of the repositories of Magnetic Oxide.

The determination of this question has required a series of observations on all the important known localities of this ore. I have been desirous of putting the question to rest, both on account of the practical importance of the question itself, and on account of the bearing it has on the origin of the ore, or those theoretical considerations connected with its original formation. There are many geologists who consider the repositories as *beds*, or an accumulation of mineral matter in irregular shaped couches. That some of the repositories are veins, no one can doubt, and there can be but little doubt in relation to all those minor collections of ore, as the whole width, direction, walls, &c. are frequently exposed by the operations of mining. It is in those cases where the development of ore is on so large a scale that its relative connexions remain concealed by earth or rock. Without resorting to the argument drawn from analogy, I may state directly the facts which bear upon the question under consideration.

1st. The direction of the masses of ore is rarely, for any great distance, parallel with the strata, or with the mountain ranges, when enclosed in rocks which are unstratified. They are, for a short distance, often parallel, but by an offset are thrown into other layers, either to the right or left, between which they preserve their course for a time, when they are again rocked, as it were, from between the last layers into a new position. According to Mr. Mather, this change occurs often in the repositories of the magnetic oxide in the highlands of the Hudson.

2nd. In the immediate vicinity of veins of ore which run nearly parallel with the strata or mountain ranges, others occasionally occur, running directly across the strata, which of course possess all the characteristics of true veins.

3d. The side-walls of the larger masses of ore, though not straight or even, or perfect for great distances, yet are so to a limited extent, and the interruptions are frequently projections of ore into the adjacent wall in the form of veins; a circumstance by which the continuity of the wall is broken, but does not seem to militate against the idea of a vein.

4th. All the repositories of ore, when they can be traversed in their whole width, present all the characteristics of a vein, enlarging and diminishing at different points, but upon the whole preserving a given width, or increasing downward at a slow rate, and cutting across the strata, sometimes at a small angle, and then nearly at right angles, and presenting, on one side at least, a wall of rock, more or less perfectly defined.

I may with propriety, refer to some examples of veins, the characters of which, cannot be doubted. The Arnold Hill, in the vicinity of Clintonville, is one, among many, to which reference may be made. On this hill, there are 4 veins, running parallel or side by side; their width varies, from 3 to 11 feet. One of these, viz. the *old blue vein*, as it is called, has been worked to the depth of 200 feet, and in length 100 rods. Throughout this extent, it preserves an uniformity of width, which is on an average, of about 4 or 5 feet. In some portions of the vein, it is only 2, in others 8 feet. It dips to the west, at an angle of about 75°. It has regular side walls, though less perfect on the west side, than on the east. The primary rocks of this country, pursue a course nearly northeast and southwest. In some instances, it is difficult to detect a deviation in the vein from the general course of the rocks. This is the case with the Old Crown Point ore, in the town of West-Port. This vein, is about twelve feet wide, and has been quarried out for half a mile, in the direction of the strata. This ore, so far as can be discovered, lies between the layers of gneiss, without crossing or shifting, from one layer to another. This would be considered a bed, according the usual definition of the term; but as there are so many instances, of a shifting of the ore, from between two given layers to those adjacent, may we not rather infer, that this is only a particular instance, in which the ore continues in parallel position, a greater distance than ordinary.

5th. There is, however, one particular in which some of the apparent beds, differ from true beds; it is in this, though they pursue a direction at the surface, nearly or quite parallel to the strata in the direction of their length, yet cut or cross them in a downward direction, or in other words, their dip differs from that of the rock. These would undoubtedly be considered as instances of veins. From considerations of the kind which I have specified it is clear, that most, if not all of the repositories of the magnetic oxide, are veins and not beds. Theoretical considerations, lead to the same conclusion, for it is difficult to resist the doctrine, that they have been formed in a manner analogous to veins, and the veins in primary rocks. That they have no analogy at all, to those beds of hematite, of the Green Mountain range, in Massachusetts and Vermont, or to the argillaceous oxide, of the protean group of rocks, in New-York, is quite evident. These are deposits of ferruginous matter, in irregular masses, and may be entirely exhausted or removed from the courses in which they lie. It is in this point of view, that the determination of the question, now under consideration, is important, inasmuch as veins extend to an unknown depth, and no instance has occurred, in which in the course of exploration, the mineral matter has been entirely removed. We may confidently expect therefore, that a vein of a given width, will furnish a certain amount of ore, at a depth not too great to become inaccessible. Even calculations may be made of the tons of ore which the vein will yield.

If then, the masses of magnetic oxide are veins, and are also analogous to veins of limestone and granite, (and of this there is scarcely a doubt,) then we may infer, that still larger masses exist in the interior of the earth, to which the veins lead, and in which they terminate. This inference, is supported by the phenomena, which the great veins at McIntyre present, and which will be noticed in the sequel; again, if this is true, then the magnetic oxide is one of the constituent rocks of the globe, and ought to be described as such, and as it appears beneath the hypersthene rock, which is a variety of granite, it ranks lower in the series than the latter. Geologists may differ, as it regards the importance of these remarks; I shall therefore, pursue them no further.

SECTION VI.

General remarks in relation to the veins of Magnetic Oxide, as they occur in the Northern Counties.

Occurring as this substance does, over a wide extent of territory, and also in formations somewhat dissimilar, it is not unexpected to find, that some differences of character also present themselves. This will appear more evident, when it is known that the ore of the same vein is far from being uniform in its characters. These differences are sometimes favorable, and sometimes unfavorable. The passage of a dyke through a vein changes the character of the ore to a certain extent; and so far as I have conversed with miners, or proprietors of mines, no satisfactory explanation has yet been given, of this fact. Veins are rarely, if ever, composed of ore in a uniform state of aggregation; in some portions it is compact, in others granular, varying from coarse to fine.

There is, however, some degree of uniformity, sufficiently so, to give a general character to the vein; thus one of the veins at Arnold hill, is called the old blue ore, and we call one of the veins at McIntyre, the *coarse black ore*, and another, the *fine ore*, which characteis they preserve as a whole.

In remarking the differences which the veins of ore present, it is proper to notice one, which evidently depends on chemical constitution. Generally, it has been already remarked, the ore gives a black streak when scratched, or a red powder when pulverized. This is not the case in the Arnold ore, though in the analysis which have been given to the public, scarcely any difference appears in its chemical constitution, from those which give the black streak. It would, however, appear to be composed of a greater proportion of the peroxide of iron, if the colour of the powder be a test of the state of oxidation. In its external character, the Arnold vein does not differ essentially, from the ordinary magnetic oxide. Its general crystalline form is that of the magnetic oxide, and as it presents no indication of the rhombic form of the specular ore, it is evidently the species already referred to. If any change has taken place in the ore, it is that which results from the absorption of oxygen, by the portion in a state of a protoxide, and one, which has taken place at a period subsequent to its deposition in the vein.

SECTION VII.

Qualities of the ore belonging to different veins.

Extended experience has established the fact, that the ore of different veins, though of the same mineralogical species, produces iron of different qualities, even when the mode of manufacture, is as near as possible after one form. As a general rule, the granular varieties, produce the softest iron, and the tough or hard, a hard and brittle iron. Besides, the qualities of the iron produced, the granular ores, make iron faster than the hard ones. Facts of this kind, are not entirely explicable; though undoubtedly, the state of division, has much to do with the facility of working, as a state of minute division, favors the action of heat.

It would appear, however, that the nature of the rock in which the ore occurs, is of more consequence than any other consideration, both as it regards facility of working, and the quality of the iron produced

When the rock is silicious, the reduction is uniformly easy; when of labradorite and hypersthene, though the reduction is not so readily effected, the iron possesses some remarkable qualities unknown to the ores connected with a silicious gangue.

The ores of Essex and Clinton counties are capable of furnishing every variety of iron which can be found, either as it regards hardness, or softness, or tenacity, and we have reason to believe that many of them, if properly manufactured, would furnish iron equal in character to the celebrated old sable. There always has been, and still is, a sufficient reason why American manufacture, is inferior to the best foreign, viz: the want of capital and skill; and so long as manufacturers must depend on the immediate sale of their products for support, just so long will the quality of the article remain below the best foreign manufacture. Another constant difference which is found to prevail in different veins of ore, is, that some are better for the forge, while others are more profitably reduced in the high furnace. Many ores which cannot be worked in the forge, make an excellent iron when first worked in the furnace; some make better castings than others, and those which make an excellent iron in the forge, do not work so well, or furnish as good castings as those which make a very inferior iron in the forge. The presence of a little sulphuret of iron is useful, for making smooth and handsome castings. Again, it is found that the lean ores are better for furnaces, than the rich. As it regards fluxes, silex appears to be the natural flux, when reduced in the forge; while carbonate of lime is preferred in the high furnace.

SECTION VIII.

Processes, preparatory to the reduction of the magnetic oxide.

Previous to the assay, the magnetic oxide requires generally, roasting, pulverizing and washing, or to undergo some operation, by which the earthy matter may be separated from the metallic. The object of roasting, is mostly to render the ore more friable, or in some cases to expel sulphur. Washing or separation, is a necessary operation in a great majority of veins, especially if they are to be worked in a forge. If they were to be smelted in the furnace, this process might be omitted, the stony matter would be in sufficient quantity only to form a flux. At one time, the magnet was considered the best instrument for separating the ores; it is, however, now going out of use. The improved mode of separating by washing, has superseded the use of the employment of the magnetic machine. Washing the ore is important in more considerations than one, as by it, iron of an uniform quality is produced; but the removal of the stony matter, alters also, the property of the iron: for example, previous to the use of the washing or separating apparatus, steel of an excellent quality was often produced, and undoubtedly, with extended experience, might have been produced at pleasure. Again, the iron produced by the unseparated ores, was remarkable for resisting oxidation. Such are some of the modifying effects of the earthy matter in mixture with the ore. The Arnold ore, is the only one which is employed without separation. Without addition, it makes iron rapidly and of the softest kind. Hence, it is much sought after by bloomers, and is frequently transported twenty miles on wagons.

SECTION IX.

Outline of the Geology of Essex County.

If an observer should commence his examination of the geology of Essex county at Cedar-Point, and proceed west, he would pass over, first, a narrow belt of the calciferous sand rock of Eaton, after which, he would meet with gneiss, and in the last place, the hypersthene rock, which embraces the great masses of magnetic oxide of Newcomb.

The first rock mentioned, exists, as has been stated, only in a narrow belt, which at Cedar-Point is not more than 80 rods in width. It skirts the country on its eastern border, but is not continuous. The primary strata appear a little north of the iron works of Port-Henry, and occupy the whole space between the latter place and Split-Rock. Upon the calciferous rock at Cedar-Point, there reposes a thin stratum of tertiary clay of the most recent of the marine deposits in this country. In the vicinity of Cedar-Point, there also occurs, heavy masses of primary limestone, and a mixture of limestone and serpentine. The latter formations either occupy beds or veins in gneiss, which extend west about nine miles. It possesses the ordinary characters of gneiss. It is traversed at different places by limestone, the hydrous peroxide of iron, and the magnetic oxide. In fact there are but few sections of country so full of ore, as East-Moriah, some account of which, has been given in the annual reports. The hypersthene rock is the most important and extensive formation in the county. It commences at the distance from the lake just mentioned, and continues nearly to the extreme western border. It is an unstratified rock, but breaks into angular blocks or tables, whose general form is rhombic. This cleavage, as it may be termed, might be mistaken in some cases, for stratification ; but the whole system of fissures, resembles those planes which result from crystallization, and not those of deposition.

As it regards the western limit of the hypersthene rock, I would remark again that it extends only 4 or 5 miles west of the village of McIntyre. We have at its western termination, a recurrence of gneiss accompanied with its usual associates, the coarse, white, primary, lime rock, narrow veins of the magnetic oxide, and probably of the serpentine and soapstone. It is an important consideration, that limestone makes its appearance so near the establishment. It may in fact, be considered as sufficiently near the works ; for it is better that all those operations which consume the fuel, should be distributed widely over the country, than concentrated at one point. The hauling of the lime a few miles, is a matter of less consequence, than the entire consumption of fuel, in the immediate vicinity of a great establishment, when operations are entirely dependent on wood. The limestone in many places, is impure. It contains imbedded minerals, as pyroxene, quartz, phosphate of lime, mica, hornblende, &c. The softer strata in the vicinity of the iron works, are peat, felsphatic clays and gravels. The marshy grounds, are sometimes shaky and wet, yet as they are invariably furnished with hard bottoms at no great depth, there is no obstacle to the construction of the best of roads over them. In concluding this outline of the geology of Essex, it is sufficient to observe, that I have mentioned the most important rocks which are found in the county. The particular localities at which they occur, is not an important subject for our present consideration ; their general arrangement may be learned by the sectional line, which has been described, when passing from Cedar-Point to the western border of the county, through Moriah and Newcomb, along the travelled road. The erratic blocks which are scattered over the surface, are the hypersthene masses, and small boulders of sandstone. The former, are by far the most abundant. The latter, have a northern origin, and have evidently been transported by agents, which are at present hypothetical. The surfaces of rocks when recently uncovered, present the usual water-worn appearances, as grooves and scratches. Having given a general account of the magnetic oxide, as it occurs in the northern section of the State, and also a brief outline of the geology of the county of Essex, we are prepared to furnish a detailed description of the ores of McIntyre.

SECTION X.

Sandford Ore.

This mine is situated upon a hill which rises 600 or 700 feet above Lake Sandford. It rises so gradually from the eastern border of the lake, that loaded teams may be driven to or from the mine, with ease. The greatest angular slope, is occupied by the ore, but does not probably exceed 25°. The portion below the mine towards the lake has a slope not exceeding 5°. The distance of the middle portion of the vein, from the lake, is about 80 rods. The ore occupies the western face of the hill, down which the slope is so equal, that an inclined plane might be constructed from the mine to the lake, for the delivery of ore, into boats, in case this measure was deemed expedient. It is two miles south from the village.

SECTION XI.

Mineralogical Character of the Sandford Ore.

The colour of the ore is black; it is moderately coarse grained, being in this respect intermediate, between the fine grained ore east of the village, and the coarse black ore on which the works are located. Structure of the mass, always crystalline, but rarely if ever, compact; lustre, dull; streak, black; sufficiently hard, to give sparks with steel; texture, generally rather firm, but never tough, and very frequently friable; constituting what miners call, shot ore. It never occurs in crystals. The surface masses of the ore, are magnetic, but rarely possess polarity. In the mass, the structure is slaty, resembling in this respect, a regular rock formation. It is probably owing to crystallization, as it is very difficult to conceive this structure to have been produced by deposition. It is not, therefore, properly speaking *stratification*, though the lines of separation are parallel, like those of veins of slate or gneiss. The existence of this kind of structure, favors very materially, the quarrying of the ore. It is even possible to remove large masses, with the assistance of an iron bar. The dip of the layers, is about 75° to the east. Much of the ore after it is raised, and has been exposed for a time to the air, becomes quite loose in its texture; and its friability is greatly increased.

SECTION XII.

Purity of the Ore.

The portions of the vein adjacent to the walls, especially on the western side, are more or less mixed with hypersthene and granular feldspar. The central and eastern portion of the vein, for the space of 300 feet, is unmixed with stony matter. The layers of rock, which appear at the western border, probably belong to the surface, and unless there is an exception to a general rule, will disappear, as the mine is worked downwards.

SECTION XIII.

Extent of the Sandford Mine.

In regard to the dimensions of the vein, it is proper to observe, that it is covered mostly with soil, varying in depth, from one to three feet, on which there is a heavy growth of timber. It is not uncommon, however, to see the ore entirely exposed at the surface. To ascertain the whole extent of the vein, as far as was practicable under existing circumstances, excavations were made down to the ore, on four transverse lines, and one in the direction of the length of the vein. Those excavations were made sufficiently large to admit of a thorough examination, whether of rock or ore, and specimens taken from each, which were labelled and numbered on the spot, to prevent any mistake. By pursuing this course, I obtained the result, which will be given in the proper place. As to the actual width, I give only that, which was obtained by measuring along the line of excavation, which was made at right angles to the vein; but it is far from being certain, that the western limit of the vein was ascertained, as in proceeding west, the accumulation of soil increased rapidly; the examinations were therefore discontinued in that direction. It is not therefore at all certain, that I am able to state the actual width of the Sandford Vein.

By the course stated above, the width of the ore on the main line of excavation, is *five hundred and fourteen feet*, and the length, along a line nearly in the centre of the vein, *sixteen hundred and sixty-seven feet.* It then passes beneath tabular masses of rock. Having given the width and length of that portion which has been actually examined, it is proper to state, that the vein disappears by passing under or beneath the rock at both extremities; that it is not discontinued, is proved by excavation at numerous places at the northern and southern extremities, where it may be seen passing beneath tabular masses of the hypersthene rock. The shape of the vein, which has been exposed, is nearly triangular.

SECTION XIV.

Explanation of the Middle Section, and description of the Ore at different points.

1st. Middle transverse section. Commencing at the western limit, or at the base of the hill, and proceeding nearly eastward, or at right angles to the vein.

First excavation. No. 1. Fine granular feldspar, intermixed with iron, garnet and hornblende.

2nd. 36 feet from No. 1. A rich ore, breaking into tabular masses.

3rd. 10 feet from No. 2. Rich ore, as above.

4th. 15 " 3. A rich ore.

5th. 20 " 4. A rich ore, mixed in a small proportion with granular feldspar.

6th. 12 feet from No. 5. Granular feldspar in a decomposing state, containing only a small proportion of ore.

7th. 20 feet from No. 6. Rich ore, mixed with a few scales of black mica and feldspar.

8th. 22 feet from No. 7. Rich ore, mixed with garnet and feldspar.

9th. 24 feet from No. 8. Nearly the same as No. 8, but brighter.

10th. 24 " 9. Rich ore, with very small proportion of feldspar.

11th. 22 feet from No. 10. Loose decomposed rock.
12th. 17 " 11. Rich ore.
13th. 15 " 12. Rich ore, with feldspar.
14th. 39 " 13. A rich granular ore, with a resinous lustre.
15th. 15 " 14. A lean ore.
16th. 22 " 15. Principally rock.
17th. 28 " 16. A pure ore.
18th. 35 " 17. A pure and rich ore.
19th. 36 " 18. A rich ore.
20th. 22 " 19. A pure oxide.
21st. 27 " 20. A pure ore.

22d.	30	feet from No.	21.	A pure ore.
23d.	29	"	22.	A pure ore.
24th.	30	"	23.	Ore mixed with garnet.
25th.	14	"	24.	Rock mixed with particles of ore.

2d. Description of the section 268 feet south of the middle section. Whole width on this transverse line, 610 feet.

No. 1. Good ore, mixed with small particles of decomposed feldspar and hypersthene.

No. 2. Same as No. 1.
3. Same as No. 1.
4. Same as No. 1, but brighter and coarser grained.
5. Good ore and fine grained.
6. Good ore, granular and friable.
7. Good ore ; granular ; colour, black.
8. Good ore, with metallic lustre.
9. Good ore.
10. Good ore.

3d. Description of the section which is south from the preceding section, 210 feet.

No. 1. Rich, black, coarse grained ore, intermixed with a few particles of decomposed hypersthene.

No. 2. Rich ore, similar to No. 1.
3. Rich ore, similar to No. 1.
4. Rich, black, compact ore.
5. Pure granular ore, coated with a greenish substance.
6. Rich ore, with slight incrustation of peroxide of iron.

4th. Description of the section 231 feet north of the middle or main section.

No. 1. Rock.
2. Rock, intermixed with iron.
3. Fine grained ore.
4. Good ore.
5.
6. Pure ore.
7. Good ore, but intermixed with crystals of hypersthene.
8. Good ore.
9. Rock.

In order to obtain a correct conception of the amount of ore on the Sandford hill, we may estimate its solid contents, or if we merely estimate the amount of ore at the depth of 2 feet from the surface, we shall find that it amounts to at least 6,832,734 tons, a large proportion of which may be removed or raised without the use of powder. This amount of ore will produce at least 3,000,000 tons of iron of the best quality, and cannot be worth less than from $100 to $120 per ton in the market.

SECTION XV.

Natural advantages for raising the Sandford Ore.

After what has been said of this remarkable vein of the magnetic oxide, little need be added in relation to the advantages it presents for exploration. It will be understood that it is easy of access, and that there are no natural obstructions to be overcome in approaching the vein, and that it, in one sense, lies open and exposed, as it were, to the light of day, as there is nothing to be removed but a light soil, excepting occasionally boulders, which have been transported here in former times.

The western edge of the vein is 200 feet at least above the lake, and it rises rapidly towards the east, so that its eastern limit is probably 600 feet above the lake. A large proportion of the vein is, therefore, situated above the waters of the lake, and under circumstances as favorable for drainage as can be desired. Water will, therefore, form no obstacle to mining or quarrying the ore. Again, in conducting the ore to the lake, or even to the works, the surface of the ground is such that a gradual descent may be obtained. In fact there can be no occasion for raising the ore over any elevation of ground. So favorable is the location, that after it is raised, it may be rolled downwards on cars or carriages, for transportation to the lake, or to the works directly. Again, the ore being unmixed with rock, no labor need be lost in removing worthless stone; and, as much surface may be at once exposed, all the operations will be conducted in open daylight for a great length of time. In addition to the advantages which this vein presents for working, I may state that of its fissile character, or its natural separation into layers; hence masses are frequently readily detached by the aid of the bar alone, especially near the surface.

It is obvious, that the true method of working this vein, is to commence on a line with the pure ore, or as far down the western slope as possible, and work towards the east, and to the right and left; by this mode of procedure, all the water which would accumulate above, from rains, &c. will be carried to a lower level than the line of the workings. The whole business of mining, then, at this place, will consist in blasting and breaking the ore, all of which may be conducted without engines of any description. Hence, as it regards expense, there probably never was a vein so favorably situated, and where so little capital will be required to obtain the ore, and transport it to the place where it is to be reduced.

SECTION XVI.

Freedom from injurious substances.

One of the most remarkable facts which I have observed, in relation to the Sandford mine, is the entire freedom of this immense vein from pyrites, and also from any substance which is known to exert an injurious effect on iron. This circumstance, is probably in part to be attributed to another fact, viz: that the hypersthene rock is one which is far from being metalliferous; scarcely any of the sulphurets or oxides appear in it, except the well known substance, the oxide of iron, whereas, gneiss, the adjacent rock, abounds in sulphurets of iron and many of the earthy minerals, and as a consequence, many of the veins of iron are more or less charged with sulphuret of iron. The ore of the Sandford vein, is one of the purest which is at present known, if we except the Arnold ore in Peru, but which is not a hundredth part so extensive.

SECTION XVII.

Quality of the Iron manufactured from the Sandford Ore.

As might be expected, the iron made from this ore has proved to be of the first quality; and it is not only of the first quality, but is said to make fast. Whether it is of the same quality as that which has been made from the coarse black ore, to be described hereafter, has not been determined. It is sufficient at the present time to say, that so far as trials have been made with it, it is equal to the best of the iron made at the forges in the northern section of the State. Experiment only can determine how good it is possible to make the product from this ore, and whether it has the properties which render it suitable for steel.

The only foreign minerals present in the Sandford vein, are hypersthene, labradorite, hornblende, and common feldspar. These, though they exert no injurious effect on the iron, yet interfere in its reduction; when these are present therefore, to some extent, it becomes nncessary to wash the ore, and this becomes the more necessary on account of the low point at which those two minerals fuse.

SECTION XVIII.

Northern and Southern prolongation of the Sandford Vein.

At the distance of about one mile and a half from the Sandford vein there is an out crop of ore, possessing the same characters as the ore just described. If this was the only vein in the country, it would be considered as very remarkable on account of its extent. It is 32 rods in length, and about 15 in width. The mineralogical characters are precisely those of the Sandford ore, and probably the qualities of the iron will be much the same as those already enumerated.

Another out crop apparently of the same ore, occurs on the opposite side of the lake, in the direction of Hill's island. It disappears under the water of the lake, and hence, its actual extent cannot be ascertained; that there is a large amount of ore at this locality there can be no doubt, and sufficient in itself, to justify the erection of extensive works. It is not easily determined, whether this is really a prolongation of the Sandford vein; it appears a few rods too far to the west to be in a line of its strike, unless the Sandford vein passes beneath the lake, which is not improbable, as the western limit has not been ascertained. The distance of the Sandford vein, from the site of the present works, is 2 miles and 53 rods, and the whole surface of the ground is such, that a railway may be constructed which shall have any amount of descent which may be desired.

From these data then, we may estimate the whole length of the Sandford vein, as about 2½ miles. Intermediate between the several large out crops, ore appears at the surface in sufficient abundance to indicate the presence of the vein beneath. We have evidence, therefore, in addition to that furnished by external characters, that of ore scattered on the surface, on the line of the strike of the main vein, an indication which rarely if ever has failed, when tested by the only sure method, that of excavation. On this subject, I may with propriety remark, farther, by referring to the experience of miners in the vicinity of the Peru Iron Works, who have frequently traced a vein of ore, simply by the presence of a few grains in the loose stones on the surface, a distance of a mile at least, and have verified their opinion as regards the presence of ore beneath, by excavation. The same fact has repeatedly fallen under my own observation.

If the application of theory is admissible, it will bear us out in these views; I refer to the theory of the origin of these veins, and to which I would invite the attention of the reader.

SECTION XIX.

Of the Vein, called the Coarse Grained Black Ore.

This vein is situated in close proximity to the site of the present works, in fact, the foundations of several of the buildings rest on this vein. It takes its name from the colour and coarse granular texture of the ore. Its texture throughout, is coarser than the Sandford ore. It is a hard ore or more tenacious; still it is not the hard ore of miners, or one that works hard, and produces hard and brittle iron.

SECTION XX.

Purity of the Black Coarse Grained Ore.

On this point, the same remarks might be repeated, which were made on the purity of the Sandford vein. The impurities, are intermixtures of the earthy minerals, as Hypersthene, Labradorite, and small masses of dark coloured Serpentine. In one or two instances, masses of sulphuret of iron, of the size of a butternut, have been seen. That no injurious substance exists in the ore, is fully shown by the quality of the iron produced from it. This is evidence of the best kind, and supersedes the necessity of making any farther remarks under this head.

SECTION XXI.

Extent of the Coarse Grained Black Ore.

With our present knowledge, it is impossible to assign definite boundaries to this vein. On a line measured east and west, and commencing at the supposed eastern limit of the vein, and terminating at excavations near the western limit of the cleared fields on the west, it gives a width of more than 700 feet. By measurement, on a line running nearly north and south or in the direction of its strike, it is found to extend 3,168 feet. The evidence of its vast extent, rests on the same data as those which were obtained of the Sandford vein, viz: excavations at numerous points. We did not proceed in a manner so systematic, as in the case just referred to; and in the several examinations made, we found the ore passing more frequently beneath the common rock of the country. To a superficial observer, this great vein might be considered as many large disconnected beds, or beds separated by intervening rock; but in this instance as in the Sandford hill, we found the ore passing beneath rocks and not terminating against them, giving thereby strong indications at least, that the apparently insulated masses of ore, are merely parts of a great vein, connected together beneath the layers of rock. Whether this view of the subject is true or false, each of the masses of ore which have been exposed, will furnish any amount which can possibly be desired. The width of that portion of the vein which furnishes ore at the present time for the forge, and has been exposed by the removal of soil, is 36 feet, presenting a solid wall of pure ore, unmixed with rock. This is only a single instance among five or six others directly in the village of McIntyre, equally favorable and in confirmation of the opinion so often expressed, that all the large masses of ore are merely portions of one vast vein. It is, however, a matter of small consequence whether this view is correct or not, so long as such an abundance of ore can be obtained at either of the exposed places, and especially when it is known that either will furnish materials for the manufacture of iron for centuries to come.

SECTION XXII.

Quality of the Iron produced from the Coarse Black Ore.

Experience has established the fact in relation to the magnetic oxide, that different veins produce iron of different qualities, even when the processes pursued are similar. Another fact also, is equally proved, that ore from which the stony matter has been separated, produces iron possessed of different properties,* from that which has been made from the unwashed or unseparated ore. An instance of the latter kind, is furnished in the iron formerly made from this ore. When first used, it was wrought without separation. The iron then made, was remarkable for its hardness and toughness or tenacity, it in fact produced steel of the best quality, and the bars which were at that period made and left in rather a damp place, preserved their smooth appearance, without presenting any disposition to rust or oxidate. This may perhaps be accounted for by supposing the formation of an alloy of iron and silicum. Whether the explanation is correct or not, the fact is important and interesting, and worthy of being preserved.

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* This result may be accounted for on the supposition, that a higher temperature is required for reduction under those circumstances.

Leaving considerations of this kind, I have only to remark, that probably no ore in this country or any other, has produced iron of a better quality than the vein now under consideration, or perhaps it would be better to say, capable of producing better iron. Without entering at all on the statement of facts in proof of the assertion, I shall refer the reader at once, to Prof. Johnson's report, where he will find a statement of the experiments which were instituted, for the trial of this iron. When it is considered, that this iron was not manufactured by the most approved process but in rather a rough unscientific mode, it seems to be clearly established, that there is something very extraordinary in this ore, to produce the kind of iron which is proved by experiment it actually does.

And who can doubt, but that in scientific hands, it will prove fully equal to the best Russian and Swedish irons, which have been so long celebrated, and used in the manufacture of steel. Such at any rate I conceive to be the qualities of the iron, that it is a matter of national importance, that the operations in its manufacture should be conducted in the best possible mode. There are some particular uses to which this can be applied, and for which there is nothing equal to it made in this country, viz: where there is much wear or friction, and at the same time great tenacity required; as the axles of locomotive engines, rail-road cars, or chain cables for ships of war, large spikes, nails, &c. Iron is so much used in the present state of society, and so many lives depending on its quality, that it is a subject of great importance, to secure for public use, that quality of iron, which shall not jeopardize life and limb in the public conveyances on the great thoroughfares of the nation. It is in this light, that an article becomes important to a nation, and though its patronage benefits in a pecuniary point of view, the individual proprietors, yet, the nation is after all the most benefited by promoting safety and expedition, on the ocean and on the land.

SECTION XXIII.

Of the Vein called the Fine Grained Ore.

This ore constitutes a distinct variety, and is peculiar in its characters. At the surface, it is always more or less granular, the grains rarely exceeding a common buck shot, and generally much finer. In many parts of the vein, it is quite friable, and belongs to that variety which is termed by miners, *shot ore*.

The greater portion of the vein is quite firm and requires a smart blow of the hammer to break it. At the place where it has been quarried, it presents a black dull appearance; it has all the characters of rich ore.

SECTION XXIV.

Extent of the Vein.

The width of the vein is about 70 feet. It has been traced in the direction of its length, 5,742 feet. It preserves a great uniformity of breadth throughout this distance, and it is far more continuous, and passes less frequently beneath the rock.

SECTION XXV.

Purity of the Ore.

Generally, at the surface, this vein appears more intermixed with rock than either of the others. I have, however, often found, that this is owing, in part, to weathering, as a large proportion of the particles in mass, though earthy in their appearance, still were obedient to the magnet. Disseminated very sparingly in the ore at some points, are minute particles of sulphuret of iron. My attention was first directed to this mineral by observing a brown stain, and instances of a thick brown rust over the face of the vein, where it was exposed to the weather. It was beneath the rust, that I detected this mineral. It is not however uniformly present, and when it is, it is quite doubtful, whether it is in sufficient quantity to affect the quality of the iron. Judging from experience, I am disposed to consider this ore as better adapted to the furnace than the other veins. The presence of sulphuret of iron, in part improves the appearance of the castings, renders them smoother, and in fact increases the fusibility of the ore.

SECTION XXVI.

Situation of the Vein.

This vein is about 80 rods east of the site of the works, on a steep ridge which overlooks the entire clearing in which the village is situated. It extends in a northwest direction, more than half a mile from the works. It possesses all the advantages of the Sandford vein for quarrying. In fact, an inclined plane from the main vein might be so constructed, as to carry the ore directly into a furnace. It is, therefore, as favorably located as can be desired, so far as mining operations are concerned, or the transportation of ore to the works.

This ore, though situated in the immediate vicinity of the forge, has not yet been wrought, it is therefore impossible to speak of the quality of the iron which the ore is capable of producing. We have no reason for supposing that it will make bad iron, or that it will work hard. These are points which can be settled only by experiment.

SECTION XXVII.

Other known veins of less extent in the vicinity of McIntyre.

Of the veins recently discovered, I may mention one on the west side of Lake Henderson, about three-quarters of a mile from the works. It is a beautiful fine grained ore, and is worthy of exploration.

Another exists on the west side of Lake Sandford, and nearly opposite to the ore bed; it is quite extensive but has not received much attention. Another exists on the east side of the Sandford hill; it is supposed to be a continuation of that vein and an out crop on that side of the hill; its extent is unknown. There is but little doubt that it is abundant, as it appears in a solid ledge.

Again, strong indication of ore exists on the East river, and a branch which falls into it, from the east. Large masses of a beautiful pure ore are scattered along each of those streams which have been brought down on masses of ice. Of the existence of one or more beds in that region, there can be no doubt, and as it will be in the vicinity of water power, they may be made to furnish the ore for an establishment on those branches. Besides, the whole will be in the vicinity of the railroad, which leads to Lake Champlain.

SECTION XXVIII.

Clays.

It is only a short time since clay of any kind was known in the vicinity of the village. It was of course a great desideratum, inasmuch as brick especially, are so indispensable to a manufacturing establishment. The clay found on the Adirondack river, is not only suitable for brick of the ordinary kinds, but from some trials made, it seems to be of the first quality for fire-brick, and not only so, but such is its fineness, that it is at least suitable for the manufacture of all the ordinary stone wares. This clay evidently results from the decomposition of the labradorite, hence it is strictly speaking, a *porcelain clay*. It has not however, the whiteness of the clays of the common feldspar, yet it seems to possess its infusibility,* which is the principal property that is wanted.

The colour of this clay is a yellowish white, with a tinge of brown, or in some instances a tinge of green. It consists of aluminous matter intimately blended with fine siliceous particles, and which imparts to it a slightly gritty feel. It is entirely destitute of the argillaceous odour. When moistened with water it is readily formed into any shape, which it invariably retains. When placed on hot coals it hardens and dries without cracking,† even when it is suddenly exposed to a high temperature. When a small mass has been exposed for five minutes, to a white heat in a blacksmith's forge, it becomes hard like stone, and acquires a very thin glazing, but does not otherwise melt or crack.

From these experiments, it is evident that this substance is quite remarkable, and must become extensively useful for many purposes, but particularly for brick of every description. This clay is found occupying the low swampy ground, through which streams pass from the adjacent mountains. It is always overlaid with gravel and sand, varying in depth according to the exposure.

The most important bed, is less than half a mile from McIntyre. It occupies a low meadow of about 10 acres, some parts of which are marshy. By sounding, its depth could not be ascertained. Another locality was found near Lake Henderson. There seems, therefore, to be a sufficient quantity in the immediate neighborhood of the establishment, to meet all the demands for it.

SECTION XXIX.

Peculiar advantages of the village of McIntyre and its vicinity, for the extensive Manufucture of Iron.

On a partial view of this subject, it might appear that a distance of 40 or 50 miles from water-carriage to the great markets, would be an important objection to an establishment which involves in its very nature the transportation of heavy articles. When we further consider, however, that such are the improvements in the construction of railroads and canals, and that scarcely any part of the country is inaccessible by the one or the other of these modes, the objection vanishes: and the only inquiry remaining is, whether the vicinity of the proposed establishment abounds in the necessary articles required for its successful operation. The *first* question is, whether there is a sufficiency of ore in an accessible situation; the *second*, whether there is wood or other combustible materials for reducing it; and the *third*, whether there is water power for moving machinery; though the latter is not so important as the former, for it is possible, that steam, in a wooded country, may be as cheap a moving power as can be employed.

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* I have since found it fusible in the porcelain furnace.

† From this remarkable property, it is eminently fitted for moulds, masks, statuary, &c.

As regards the *first* of these inquiries, it is a very plain case; for there can be no doubt as it regards the quantity as well as the quality of the ore in accessible positions. From what has been said in the preceding pages, respecting the great amount of ore in either masses, it will be perceived, that such is the thickness and extent of these masses, whether considered as veins or beds, that the ore has only to be quarried as the common rocks of the country for a long period to come: therefore, the heavy expenses incident to mining are saved.—These incident expenses not only include the machinery for raising ore and draining the water, but a vast amount of labor. All the varieties of ore which can be deemed necessary, are found in the village and its immediate vicinity. The coarse grained ores are suitable for the production of malleable iron and steel. Their purity qualifies them for those purposes. The fine grained ore is suitable for castings, it being a leaner ore, blended somewhat with pyrites. The presence of the latter substance aids, it is thought, in the perfection of the castings from the moulds, and secures smoothness of surface. Probably, no portion of the world can vie with McIntyre in its ores of irons; even the far famed Iron Mountains of Missouri are eclipsed by the rich ores of Essex county, New-York; and if not in quantity, at least in quality; for the ore of those Iron Mountains contains quite a large amount of sulphuret of iron, which must injure the quality of the iron produced from it. It is not, however, our business to detract from the merits or resources of our western sister, but to present in their true aspect the distinguished advantages possessed by New-York for the manufacture of this important article, and especially that portion of the State under immediate consideration. If we were disposed to enter into calculation, it would be easy to demonstrate, that *either* of the great veins which have been described, cannot be exhausted for centuries.

The *second* inquiry is, whether there is wood in sufficient abundance to justify the establishment of iron works on the most liberal scale. On this point I may observe that the village of Mc Intyre is situated in the midst of an unbroken forest. Towards the east, there is at least 25 miles of forest. To the south it is 16 miles to the Pendleton settlement. In other directions, the extent of unbroken forest is much greater. It will be perceived, then, that there can be no lack of fuel for a long period, if these resources are properly husbanded. The abundance of wood is that which gives so much value to this locality. It is a positive good, and nothing yet discovered can supply its place if it were wanting; for it is agreeable to the experience of all who have been in the manufacture of iron, that charcoal and wood are the best combustibles which can be employed. Coke and mineral coal are resorted to as substitutes, when the former cannot be obtained. When we look at the whole subject, it seems to be worthy of remark in the affairs of this State, that so wide an extent of territory has been preserved in its primitive state, untouched by the axe, until its mineral value should be fully known, its peculiar riches pointed out, and the mode by which they can be made available, well understood. For had the progress of settlements gone on as in other sections of the State, the forests of timber would have been, ere this, so far prostrated as to diminish greatly the use, for which nature seems to have intended them. The neglect, therefore, which this portion of the State has suffered, will prove an ultimate advantage. The time has arrived when the inquiry is made, not only into the value of production *on* the surface, but beneath it; and it is hoped, that the policy will no longer prevail of converting, indiscriminately, the products of the vegetable kingdom, so slow of growth, into ready cash, by the unsparing axe of the husbandman, but that some regard to the future may be paid both to questions of taste and utility.

With regard to the *third* inquiry, whether there is water power for moving machinery, I need only remark, that the amount of water fall, and the number of mill sites within short distances of each other, in and near the village, will afford any amount of water power that can be desired.

In giving an account of the iron ores of McIntyre, it can scarcely be considered unjust to other sections, where similar ore occurs, to state the peculiar advantage of this place above others at present known for the manufacture of iron. It is in fact proper that the truth should be extensively known and circulated, that the community may prize the resources at home, and that a commendable pride should be felt in encouraging the manufacture of an article, the demands for which are constantly increasing. For a long time to come this must be the case; for though a large amount of iron is made, and will probably increase in the mineral coal districts in the Union, still, the ores found there, do not, or have not furnished a quality of iron suitable for steel, and the stronger and tougher varieties of iron so much in demand, and so necessary to the perfection of machinery.

If we compare the prospects of an establishment at this place, with others in this country which might be named, and are in successful operation, the former would appear to great advantage. If, for instance, there are inducements to embark in the manufacture of iron, where the ore costs at the mine $5 per ton, and which has to be transported over a rough country on wagons 4 and 5 miles, and in some instances 20; and at the same time charcoal cannot be obtained at a distance much short of 6 or 8 miles; I say, if under these circumstances it is a profitable business, (and large dividends are realized,) what may not be expected where the ore cannot cost more than $1 per ton at the works, and an abundance of coal may be obtained in their immediate vicinity at $3.50 to $4.00 per 100 bushels. To these considerations must be added the superior iron which the ore produces. This, in my estimation, is one of the greatest advantages which the manufacture at McIntyre will have over all others established in this country. On this point I do not speak problematically, but proof is furnished from the experiments which have been instituted, and which have resulted in the establishment of this position. I refer to a report of experiments on this iron by Prof. W. R. Johnson, published in Silliman's Journal, and in the Journal of the Franklin Institute, and also appended to this report.

In the progress of this report, I have had occasion to refer to other collections of the magnetic oxide of iron, in this and the neighboring counties. I have made those references for the purpose of imparting correct opinions of the nature of the depositories of this species of mineral. It will have been perceived, that the localities at which this species occurs, are somewhat numerous. These, though they are important, and have been successfully worked, still, in the comparison of quantity with those of McIntyre, they are only as the spatterings from the great cauldron, in which those ores have been formed.

The site of the village of McIntyre, is not far from what will be one of the great lines of communication through the State. Situated as it is on the table land of the north, it can have a communication east to Lake Champlain ; or south, through Long and Racket lakes ; or northwest, down the Racket river to the St. Lawrence, and thence to Canada.

SECTION XXX.

Theory of the origin of the Veins of the Magnetic Oxide.

The complete establishment of any doctrine in geology, as in all other branches of science, requires an extensive series of observations. Ample time for observation and reflection must be given to the subject before a theory can be established, or even advanced with propriety. Hutton, after an extended series of observations led the way to the establishment of the doctrine of the igneous origin of granite and basalt, and consequently to the overthrow of the theory of Werner. Since the day of Hutton, his doctrine by farther elucidation, is confirmed, and it is now the received doctrine of the day. Since then, the theories in relation to the formation of other rocks have likewise undergone similar changes, so that igneous rocks are spoken of with as much confidence as those formed by deposition from water.

Applying the same rules of reasoning as have been employed in establishing the igneous origin of granite, and we shall probably arrive at the same result, as it regards the origin of the magnetic oxide. A moment's consideration only, is required to reject the theory, that those veins are of aqueous origin. The idea that they may have been formed by electro-magnetic agency, is quite difficult to support, when such immense quantities of matter are concerned. We are left, then, to adopt the igneous theory, almost by necessity. We may now ask, what phenomena do those veins present, which go to show that the materials were ever in a state of fusion, and were projected upwards into fissures while in this state.

In the first place, there is presumptive evidence of this, arising from the fact that the magnetic oxide* is always associated with igneous rocks, and in fact embraced in them.

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* There is no improbability of their being contemporaneous with the rock, and to have been acted upon by the same agents.

In the second place, there are often seen branches extending off from the main vein, which are similar to those which granite sends off laterally, or obliquely, from a great mass.

Again, there are many instances both on a large and small scale, in which the mass widens as it proceeds downwards. Such is the case with the great mass of ore at Lake Sandford.

In searching for changes of structure, in parts of the rock adjacent to a mass of ore which would bear the appearance of heat, we do not discover that evidence which presents itself, when an igneous rock comes in contact with one of aqueous origin. We, however, discover a change of a different kind, which we are disposed to attribute to the agency of a mass of melted matter on the rock; it is the conversion of rock into garnet, a change, which requires only the chemical union of iron with the earthy matters composing the labradorite; and a change of this kind appears possible, while the materials are in a melted state. This view of the subject, is sustained by the fact, that garnet does not occur in the rock, except in proximity with the ferruginous masses.

Without pretending to establish the doctrine of the igneous origin of the veins of the magnetic oxide, I have only to remark that all the facts which have been observed, favor the doctrine expressed above; but a greater number of observations and facts are required, to establish it, and place it on the same ground, as that of the igneous origin of granite and basalt.

SECTION XXXI.

Face of the Country, Lakes, Timber, &c.

The face of the country, is both hilly and mountainous. To the northeast of the Adirondack Iron Works, at the distance of about 15 miles, is Mount Marcy, the highest mountain* in the State. Surrounding it in all directions, are other peaks of lesser elevation. In the immediate vicinity of the works, the mountains are comparatively low, and the valleys between them of considerable extent. The arrangement of the mountains, and the connexion of the valleys, are such, that no formidable obstacles are presented in approaching the establishment; that is, there are no mountain barriers to prevent access, either by good common roads, or by rail roads, on which locomotives may be propelled by steam. The height of the village of McIntyre above the level of the sea, as ascertained by barometrical measurement, is about 1800 feet. This height is about the uniform level of the table land, of the north section of the State. When overcome, we may travel over a great extent of country, either by ordinary modes, or by canoes, batteaux, &c. by means of the lakes, which are here and there spread out, and which are connected more or less together by their outlets, and which are also nearly on uniform levels. By lakes and their outlets through low passes between the hills, we may pass to the larger lakes, to the southwest, viz: Long and Racket lakes. This may be considered an important fact, for it leads to an immense extent of wooded lands of the best kinds, and which would be of great importance to the Adirondack works, if they were not already surrounded by forests. This consideration, however, serves to dispel all fear in relation to the ultimate failure of fuel.

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* The height of this mountain is 5,467 feet. Mr. Johnson, however, gives the height as much less, and he has made an elaborate statement in Silliman's Journal to prove that his measurement was right and mine was wrong. This was quite natural. Proof has been furnished since his report, that he is in error only a little over 400 feet.

The timber of the higher mountain tract, is spruce, pine and balsam; of the lower, a mixture of spruce, pine, larch, cedar, maple, beech, birch, with a little ash and hemlock; intermixed, are lesser patches of entirely hard wood. The whole country, except the higher mountains, may be considered as heavily timbered, for though the growth is not so large as on the rich alluvial bottoms of the western part of the State, yet, the trees are more numerous, and would furnish nearly an equal amount of wood to the acre.

SECTION XXXII.

Adirondack River.

The Adirondack river rises in two principal branches, in a north and northeasterly direction from the village of Mc Intyre. The northeasterly one is, between 4 and 5 miles in length; and the northerly is full 5 miles long, and takes its origin in the great Adirondack pass. The branches form a junction at the above named village, and from thence pursue a southerly course for 7 miles, when they mingle their waters with the Opalescent river. The Adirondack in its course, flows through two important lakes, the upper one is, Lake Henderson, which is two miles long, and from 40 to 160 rods in width, the lower, is Lake Sandford, and is about 5 miles long, and from 20 to 100 rods in width.

It drains so wide an extent of mountainous country, (and which is entirely covered with a heavy growth of timber,) that it forms a river at the works, whose width is 40 feet, with an average depth of one foot. It flows rapidly over a rocky bed almost its whole length, excluding of course its passage through the above named lakes. The most important portion of the Adirondack is between those lakes, whose relative position, together with Opalescent river, may be seen on the county maps.

The portion referred to, is about two miles in length, in which distance there is a fall of 90 feet and a fraction, and which furnishes space for 5 mill sites, without interference with each other. The amount of fall at each site, varies from 13 to 15 feet. The most important of these is, at the outlet of Lake Henderson; it is important, as connected with this lake, inasmuch, as it may be used in a dry season as a reservoir.

The dam, as it is now constructed at this outlet, forms a basin which holds in reserve about 99 millions of gallons of water; this quantity may be increased to 180 millions, by raising the dam 10 feet, which quantity of water, would furnish a supply for daily expenditure, during 60 days, of 3 millions of gallons. For the measurements, I am indebted to Mr. E. N. Horsford's Report to the proprietors of works situated on this river.

To prevent however, any apprehension of a failure of water during an excessive drought, it has been proposed to turn the upper waters of the Opalescent river, into the east branch of the Adirondack, the source of which is some 160 rods below Lake Colden, at which place there is a low pass of only 18 feet perpendicular height, which divides the source of the one, from the bed or channel of the other. To unite those waters, requires only a dam below this pass, whose bottom shall be 33 feet; the top requires a length of about 50 feet, while the height need be only from 19 to 20 feet, in order to flow through the pass without excavation. The change in the direction of those waters, would increase the amount at the works, about 50 per cent, and furnish many additional mill sites of great power along the east branch of the Adirondack. But to satisfy all demands for water, which the most extended works may require, there is in reserve all the waters of the Opalescent river, which fully equal that of the Adirondack. The river, is about two miles from the works by a wooden rail-road. Above the intersection of this road, the river descends for 3 miles from the great falls, in a series of rapids; furnishing at many points, safe and convenient mill sites.

SECTION XXXIII.

Sand.

Accompanying the clay, or in near connexion with it, there occurs *Sand*, both in a fine and coarse state. Its appearance leads me to conclude, that it is formed from the decomposition of the hypersthene rock. It is composed of grains of dark coloured labradorite and quartz. The latter predominates greatly, and may, therefore, be considered as a siliceous sand. It is scarcely necessary to enter upon a detailed description of the beds occurring in this vicinity, though the fact of their existence is of great importance. From experiments which have already been made in bricks, it is found necessary to add freely of the sand to the clay, in order to form a mortar, which shall be of a suitable composition. The close proximity of the two substances is a circumstance worth noticing in this region, inasmuch as it was formerly quite doubtful whether they existed in sufficient abundance to become articles of importance to the settlement. Those doubts are now happily removed, by the discovery of both in sufficient quantity to meet all demands which can probably be made for them.

Fire Clay.

In a note to page 295, it will be seen that the clay, which is there described as a *fire clay*, has not been confirmed by experiments which have been made with it in a porcelain furnace. It is proper to remark, however, that no doubt exists in relation to the origin of the clay, viz: that it is a product which arises from the decomposition of a felspathic rock, but which has not undergone a perfect change. It is still a valuable clay, but as it contains portions of lime and soda, it is fusible at a high temperature. Though the particular locality from which the specimens which have been subjected to trial, and that a severe one, has failed in proving the correctness of our former conclusions, still we are not to suppose that a fire clay does not exist in this region, and it is highly probable that when the surface clays have been removed, at some localities, clays highly refractory will be found. However this may be, we have to state that a *ferruginous clay* does exist in abundance, on the banks of the Opalescent river, which may be considered a true *fire clay:* I shall speak of it, however, as a yellow ochre.

Yellow Ochre.

From trials which have been made with this form of ferruginous clay in the *porcelain furnace,* it is found absolutely infusible. It appears, therefore, for no analysis has yet been made of the ochre, that the quantity of iron is not sufficient to operate as a flux, neither is there a mixture of silex, as it would in that case be fusible. The most remarkable character which appears in this ferruginous clay is, the brightness of its colour. On exposure to heat, it assumes a lively brown, which is superior to the common Spanish brown. We have, therefore, not only a fine clay, or one which may be employed for fire-bricks, crucibles, &c. but one which furnishes a superior pigment. The composition is evidently that of the porcelain clays, with the addition of iron, in a sufficient quantity to impart to it a fine yellow hue, and also, by burning, a bright reddish brown. It is now used in the Jersey City Works, and is found superior to any hitherto employed.

Confirmation of former views, in relation to the purity of the Ore of the Sandford Vein.

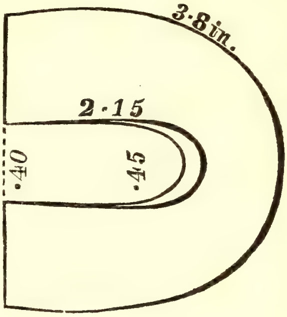
Since the preceding account of the Sandford vein was written, an excavation has been made in it about its centre. This excavation is 10 feet in perpendicular depth, and about 20 feet wide, and about 30 in length. After the removal of the surface, the whole excavation presents entire layers of ore, without a particle of rock, a large portion of which is of the soft or granular kind, a variety much esteemed and sought for by bloomers, inasmuch as it requires no washing, and makes iron rapidly in the common forge. Without occupying farther time and space in the description of this or the other veins, I shall merely remark, that this improvement in the purity and goodness of the ore, is in accordance with the every day experience of miners.

SECTION XXXIV.

Extract from a report, by Prof. W. R. Johnson, of Experiments on the iron, manufactured at the village of McIntyre, Essex county, New-York.

To ascertain the toughness and ductility of this iron when cold, I caused the bar to be bent at a temperature of 50° at a part where the breadth was 1.295 inches, and the thickness .59 inch. This bend was made flatwise, and continued until the corresponding faces on the inside, about one inch from the middle of the inner curve, were four-tenths of an inch apart, and the widest part of the opening only .45 of an inch. The alteration in the form of the bar appeared to be limited to this portion. On measuring along the interior and exterior edges of this curve, the former was found to be 2.15, and the latter 3.8 inches, manifesting a difference in the length of the inner and outer fibres of 1.65 inches in a length of about 2¼, the original extent of the bent portion. See Fig. 1.

Fig. 1.



By this trial the whole form of the cross section of a bar is changed, and instead of straight lines exhibits only curves. In the present case the parallelogram Fig. 2, was converted into the form of Fig. 3, the largest curve being on the inside of the bend.

Fig. 2.

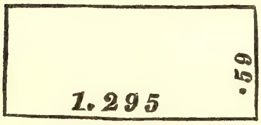
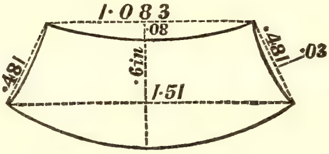


Fig. 3.



This change of figure and displacement of parts were borne without exhibiting any signs of rupture until the curvature above stated, had been attained, when a few cracks began to appear on the exterior part of the curve.

The next test to which this iron was subjected, was to heat a portion of the bar to redness, quench it in cold water and then bend the same portion cold, in the manner already described. No difference of result was obtained except a greater facility in producing it. A few slight surface cracks were seen near the close of the operation.

A third trial of a similar kind on a bar annealed and cooled in dry ashes resulted like the preceding, but exhibited rather more cracks on the exterior surface of the bend than either of the foregoing.

Another trial of the toughness of this iron when cold, was made by drawing out a bar .7 of an inch wide, .18 inch thick, and 5.4 inch long, and twisting it cold in the manner of a common twisted auger, twice round in the length just specified. The edges of the spiral were now exactly 7 inches long. Hence, the elongation of the exterior fibres on the edges was $\frac{.7-5.4}{5.4}$—29.6 per cent. It is proper to state that this experiment was made after annealing the bar, and cooling it off in dry ashes. In attempting to carry the torsion beyond this extent, the bar was twisted off at the jaws of the vice, in which the operation was performed.

Having thus proved that this iron is not under any circumstances *cold-short*, I caused the bar 1$\frac{3}{8}$ inches wide, and .6 inch thick, to be heated to a fair working red heat, and in that state bent flatwise over the corner of an anvil, and a right angle exterior and interior to be formed $\frac{3}{4}$ of an inch from the end. The exterior angle remained perfectly sound. On the interior, a thin scale only of metal appeared to be corrugated and partly detached from the rest of the mass, owing, probably, to a defect in welding—but not the least sign of a tendency to fracture was discovered. Another portion of the same bar was heated as before and 3 inches of it bent over and hammered flat upon the face of the adjacent part.

Complaints are made by workmen that much of the iron which they employ will not sustain either of the two preceding operations. They were, however, borne by the iron under trial, without evincing any weakness or undue distortion of parts.

A third test of the quality of this iron, when hot, was afforded by heating about 3 inches near the end of the bar and driving a steel punch .8 of an inch in diameter, quite through it. This was done without splitting or cracking at the edges, as is too often the case in making screw nuts. Machinists are well aware of the importance of a good material for the formation of screws and nuts.

The foregoing trials having, as it was conceived, fully established the freedom of this iron from the defects known either as *hot shortness* or *cold shortness*, and its softness and malleability being amply tested by the cutting and hammering incident to these experiments, the next step was to determine the absolute force of cohesion, together with the extensibility, when subjected to longitudinal strain, and the interior structure of the metal under various circumstances, including that of welding in the ordinary way.

For this purpose five bars were drawn out and prepared from the specimens already described, numbered I, II, III, IV, and V, each about 9 or 10 inches long, 1 inch wide and .2 inch thick.

No. I. after being reduced to a nearly uniform size throughout its length, was annealed at a red heat and allowed to cool slowly in the air.

No. II. was *hammer hardened*, or beaten with moderate force, throughout its length until it had been for several minutes black, the hammer being occasionally moistened during the process.

No. III. was forged out and hammered till it was only visibly red in daylight, being left at about the temperature at which workmen cease their operations on many of the articles which they produce.

No. IV. after being brought to an uniform size, was upset for about 3 inches, in the middle, and was then annealed and cooled slowly.

No. V. was drawn out, cut into in the middle, and welded together. This sample was only 6½ inches long.

All these bars were then carefully gauged, both in breadth and thickness, at every inch of their lengths, before commencing the trials of tenacity. The machine employed in testing them was the same which had been used in experiments made at the request of the Treasury Department, on the strength of materials for steam boilers, for a description of which the reader may be referred to the report on that subject.* The following table will be understood without any other remark than that the breaking weights in the 5th column, are corrected for friction of the machine. The specific gravities of several of the fragments of each bar after it had been broken up, are given under the head of observations, and may serve as well to illustrate the general character of the iron in this respect, as to indicate the effect of the several methods of preparation on the density of iron.

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* See also Journal of the Franklin Institute, vol. xix. p. 84.

The following experiments confirm the evidence already adduced of the great toughness and ductility of this variety of iron. Besides the facts mentioned under the head of *observations* in the 7th column we may add that after the first fracture on each bar, a measurement was taken between two of the inch marks still remaining on one of its parts and the following results obtained, viz:

No. I. In an original length of 6 in. had been elongated .87 in.= 14.5 pr. ct.
II. " " 4 " " " .2 "= 5 "
III. " " 5 " " " .6 "=12 "
IV. " " 4 " " " .2 "= 5 "

TABLE.

Experiments on the Tenacity of the Iron.

o. of the bar.	State of the bar.	No. of the experiment.	Area of section before trial in sq. inches	Breaking weight in lbs. avoirdupois.	Strength in lbs. per sq. inch,	Observations.
I.	Completely annealed.	1	.1890	10.175	53.820	Length before trial, 10 inches, after, 13.5—total elongation 35 pr. ct. Sp. Gr. after trial 7.685, 7.676, 7.668. Mean = 7.676. After the 4th fracture the area of section was .1064 in. instead of .1986 as at first, diminution 46 per ct. Mean strength of this bar 53.311. Greatest difference 1706 lbs. = 3.2 per ct. of the mean.
		2	.1929	10.288	53.336	
		3	.1954	10.345.5	52.945	
		4	.1986	10.374	52.235	
		5	.2036	10.972.5	53.941	
		6	.2057	11.029.5	53.614	
II.	Hammer hardened.	1	.1980	12.967.5	65.492	Length before trial 9⅛. in, after, 11 in.—total elongation 20.5 per ct. Sp. Gr. after trial, 7.769, 7.756, 7.779, mean = 7.768. Mean strength 65.713. Greatest difference 2348 lbs. = 3.5 per ct. of the mean.
		2	.2019	13.053	64.650	
		3	.2000	13.399.75	66.998	
III.	Hammered till nearly black.	1	.1983	11.970	60.363	Length before trial 9.5 in., after, 12¼—total elongation 28.94 per ct. Sp. Gr. 7.760, 7.778, 7.662, mean = 7.750. After the 2d fracture the area of section at the point of fracture was .1176—diminution 45.2 per ct. Mean strength 58.912. Greatest difference 2.444 lbs. = 4.15 per ct. of the mean.
		2	.2151	12.454.5	57.919	
		3	.2163	12.768	59.029	
		4	.2213	12.910.5	58.339	

TABLE—(CONTINUED.)

No. of the bar.	State of the bar.	No. of the experiment.	Area of section before trial in sq. inches.	Breaking weight in lbs. avoirdupois.	Strength in lbs. per sq. inch.	Observations.
IV.	Upset in the centre and annealed.	1	.2086	13.110	62.847	Length before trial 9, after 11.2—total elongation 24.46 per ct. of original length. Sp. Gr. after trial 7.813, 7.731, 7.754, 7.634, mean = 7.733. Mean strength 63.142. Greatest difference 7.128 lbs. = 11.2 per ct. of the mean. The last two results belong to the upset portion of the bar. The thickest part of the upsetting remained, however, unbroken.
		2	.2233	13.623	61.007	
		3	.2316	13.737	59.313	
		4	.2282	15.162	66.441	
		5	.2354	15.561	66.104	
V.	Welded together near the middle, hammered till nearly black.	1	.1845	10.773	39.585	Broke outside of welding. The strength is about the same as in No. III.

To compare this iron with others, it is proper to assume bar No. III. as the standard, that having been hammered till of a dull red heat. The report already cited furnishes us with abundant data derived from experiments, made with the same machine, on other kinds of bar iron, in a similar state. Thus we have—

				Strength in lbs. per sq. inch.
Iron from	Salisbury, Conn., by a mean of	40	trials,	58.009
"	Sweden, "	4	"	58.184
"	Centre Co. Pa. "	15	"	58.400
"	Lancaster Co. Pa. "	2	"	58.661
"	McIntyre, Essex Co. N. Y. [as above]	4	"	58.912
"	England, cable bolt [E. V.]	5	"	59.105
"	Russia,	5	"	76.069

Hence it appears that the last only is essentially superior to the iron of McIntyre. These are among the best varieties of bar iron in point of tenacity.

The fracture is of a light iron grey colour, silky lustre, and generally displays a compact structure. It is worthy of remark that most of the fractures took place in directions oblique to the line of tension and making with it, either in the breadth or thickness, one or more angles of about 60 degrees each.

The fibrous structure of the metal was very marked in cutting with the cold chisel and was further developed by acids on a part of No. III, on the surface of which delicate lines were shown traversing a distance of several inches. The specific gravity in the annealed state was, it appears, increased 1.2 per cent by hammer hardening.

In conclusion it may be observed that as a large and increasing demand for good iron prevails in the United States, in proportion to the increase of finished and accurate machinery requiring superior materials as well as workmanship, there can be no doubt that any quantity which could probably be produced, if possessing the properties of that above described, would command a ready market and the best of prices.

IRON ORES OF ST. LAWRENCE AND JEFFERSON COUNTIES.

It is a fact worthy of particular consideration that the ores of St. Lawrence and Jefferson belong to different mineralogical species from those of Essex, Clinton, Franklin and Warren counties; a difference for which it is not easy to account. The specular ore, which is a peroxide of iron and always gives a red powder, though black in itself, is peculiar to the former counties, while the magnetic, which is a combination of the protoxide and peroxide, belongs to the latter. There are no instances of the occurrence of the specular ore on the eastern side of the Adirondack mountains. There are, however, veins of the altered magnetic oxide; for instance, there is a collection of ore in Crown-Point, known as the Saxe ore bed, in which the ore has probably been changed from the magnetic to the hydrous per-oxide of iron; and again, the Arnold vein, without doubt, has been so far changed as to give a decided red powder; though the structure and crystalline form remains as in the magnetic oxide. In the Saxe ore bed the structure has become fibrous, and resembles the Limonite of Authors. The specular ore belongs to a formation in which the primary limestone forms a large part. This is the only geological condition in which the rocks in the two districts differ. Both species of ore belong, strictly speaking, to a primary formation; but the limestone of the St. Lawrence exceeds that on the Champlain side; and, moreover, the specular appears to have a more or less intimate connexion with limestone. It is, perhaps, sufficient to state the fact, without entering upon the speculation *how* the limestone can have produced the change. In regard to the geological position of the two species of ore, it is evident that the hypersthene rock, that which constitutes the central portion of mountains of the northern part of the State, is the true location for the magnetic oxide. In this it is developed to the greatest amount; though it is not confined to it, it will be seen, however, on comparing the amount of ore in the hypersethene rock, and the ordinary granite and gneiss, that a single vein in the former equals all the veins of the latter rocks put together.

The specular oxide may be found in two geological positions; in the first it is associated with primary limestone; in the second with gneiss or some other primary rock beneath, and the Potsdam sandstone above. Examples of the first geological position are furnished by several collections of ore in Edwards; and of the second by the Kearny and Parish ore beds in Governeur. In addition to the limestone, serpentine is a common associate. It is sometimes in pure, separate masses, and then in others, it is in intimate mixture and combination; giving in the first instance a spotted, and in the last a mottled appearance to the rock. The character of the beds or veins of specular ore is now well understood, especially those which are connected purely with the calcareo-serpentine rock. At the surface, they are quite promising in many instances, but exploration soon reveals the fact that they, (frequently at least,) are but superficial collections of ore. They are found to be wedge-form masses, or masses which thin out entirely in the downward direction. The quantity varies exceedingly. In one instance 120 tons were raised, in another, between 500 and 600 lbs. In the last instance, the whole mass was moveable with a bar; it was in place, but decomposition had entirely separated its connexions with the parent rock. There are instances, however, in which a true vein apparently exists, or in which those masses extend into the rock without decreasing in width. The nature of these collections of ore, I consider to be attributed to the origin of the rock which embraces them. As it regards my views of the origin of limestone and serpentine, I refer the reader to the report for 1838.

Perhaps I ought not to consider that every collection of the specular oxide, is as limited as in the instances cited, or that even there is an exhaustion in those instances; there is, however, so much derangement, if more exists, it is quite difficult to discover it. In raising this variety of ore it is no uncommon thing to meet with an insulated mass of it in the rock, as if an excavation in the rock had been made of the size of a pail, and subsequently filled with ore.

The most abundant variety of the specular ore, is that which occurs of a deep red colour, and frequently in red powder or bright shining scales, which by a slight pressure becomes a red powder. Instances of these are furnished by the Kearney and Parish beds, the new bed discovered in Theresa and the Tate bed in Hermon. The two former beds belong really to one, as has been proved this last season, and which is agreeable to an opinion I have often expressed. It is quite difficult to form an opinion in regard to the nature of the collections of the variety of ore. No side walls have as yet been discovered, though they appear to pursue a determinate direction. There is too, a great difference in the quantity of ore which they contain; some, as in the instances cited are apparently inexhaustible, while others are merely a mass of red earth in which there are a few lumps of hard ore. There are many of those smaller collections between the sandstone and the primary rocks beneath. These are so frequent and common that I have no hesitation in considering the position as geological, and as having depended on a cause which operated generally at this particular period.

The position spoken of above, is confined to the upper portion of the primary strata and lower layers of the Potsdam sandstone. It is rather remarkable that this rock, which is so generally connected with this deep red ore, is not higher coloured throughout, for its general colour is white, at most but pale red or reddish, with a tinge of brown or yellow. In some places, however, it is deep coloured, but I have generally found those to be connected with some local disturbance.

Of the localities of specular ore it would be possible to enumerate a great number in the counties of St. Lawrence and Jefferson. I shall confine my remarks, however, to the most important, inasmuch as it is from them we are to derive the most information. Among those, I may class the Kearney, Parish, Sterling and Theresa beds.

The two first belong truly to one bed, as has been proved by intermediate openings. Besides, it probably extends south or southeast some considerable distance, as seems to be indicated by an out crop of ore in that direction. Indications appear also of the extension of the bed still north or northeast of the Kearney bed. This bed may then, without exaggeration, be traced at least a mile. Though we may trace it thus satisfactorily upon the surface, still it is not possible yet to determine its lateral extent. As it is now exposed, it has the character of a bed, laying as it were between the primitive rocks and the oldest of the sandstones. Still, it is possible that not only this, but all the masses of ore termed specular, may prove to be in veins, being the upward extension into the sandstone from the primary mass. The following facts have a bearing on this point. 1st. There are numerous places where this ore has no other connexion than with the primary. 2d. There are strong reasons in support of the position, that at these localities the sandstone has been removed, and that they were formerly in the same geological relations as the range in which the Parish and Kearney beds are now found. There are every where abraded surfaces and fractured strata, and it appears that the sandstone was once continuous over wider areas than it now appears, as we find its remains as far east as the specular is known to occur. According to this view, the sandstone, together with the red ore, has been removed; and according to well known facts, the whole must have been carried south. And what do we find in that direction? Not only beds of red oxide of iron, mixed it is true with argillaceous matter, but also siliceous rocks, the red sandstone and the gray band of Professor Eaton, &c. in connexion with this argillaceous oxide.

Could we establish the connexion which we have now supposed may have existed between the rocks of St. Lawrence and Jefferson and those of the counties south, it would be an important link in the chain of facts connecting the origin of those rocks, the relative period of deposit, the slope of the country, the direction of the valleys, in fine it would be the gathering up of a mass of history of ancient times of the most interesting character, and bearing generally on the geology of the State.

The establishment of a fact in antient geology is often difficult, while the inferences from it are comparatively obvious. It may be that we shall never be able to do this in relation to the ores we have just spoken of; and it may be, that all we ever shall be able to say will be, the argillaceous ores exist; they are found above and in connexion with sandstones; they are mechanical deposits; they came from some foreign source, and transported matter was carried from north to south; therefore the beds of argillaceous iron may have been transported from the northern counties to the more southern. There is in this view, if admitted, a beautiful exhibition of prospective care for the wants and necessities of man. We may suppose, that in the north are vast beds of this invaluable substance, far more than can be necessary for all the uses of those who may dwell there; but in the progress of reducing to order the earth's surface, and bringing it to the best possible state to meet their wants, those northern rocks were broken up, and their valuable contents pulverized and transported to a more distant land; one which, acccrding to the established order, would not contain this mineral, unless carried to it by the means we have supposed. It is a case similar to that of the accumulation of carbonaceous matter from the great stores which existed at a certain period in the earth's history, and like that, is an instance of prospective wisdom, and provision for the future.

The red ore already spoken of as the Theresa bed, is about 4 miles east from the falls. Its general appearance is much like the Parish ore. It occurs in the sandstone, like that, but is in general a leaner ore. It is, however, a new bed, and had only been opened a short time; all that was exposed was surface ore, and probably inferior to that beneath. This bed had been traced a mile in a northerly direction; hence the indications for an abundance are not inferior to the range in which the Parish and Kearney beds are situated. It is carried to Carthage for reduction, and was said to be excellent. Being situated, however, only 4 miles from the Highfalls, it will probably find a market there, inasmuch as the falls form one of the finest water privileges in the northern counties, and besides, there is not a lack of wood for coal.

In this connexion, I may mention another *new bed,* on or near Muscolunge lake, which, in case of the improvement of the navigation of Indian river, could be transported to the falls for reduction by water.

Qualities of the Specular Ore.

It is particularly valuable for castings, as it runs smooth and exhibits a beautiful finish. It is not used in the forge, or made directly into malleable iron. It makes, however, good bar iron from the pig.

It was supposed formerly that the bright crystallized variety could not be worked. It was undoubtedly a whim or prejudice of the workmen employed in the first trials. It was said to contain arsenic, and to have created sickness and vomiting. Proper trials, as was predicted, have proved the falsity of those assertions. It is an excellent ore, does not contain arsenic, and never exhales an unpleasant or poisonous vapor. As a general rule, the opinions of many of the bloomers and furnace-men are to be received with some allowance.

Associated Minerals.

There seems to be a great uniformity in the kind of mineral substances found in these beds. They indicate, therefore, a common origin. We may enumerate the following as constant attendants of the specular ore: sulphuret of iron, quartz, either amorphous or in crystals, an interesting and rare form of the latter is the dodecahedron, carbonate of iron in amorphous masses or in crystals, sulphate of barytes, carbonate of lime in thin fibrous individuals, and also in crystals. The most common form is the nailhead spar. Serpentine, green and brown, with a remarkable distinct conchoidal fracture, and a very perfect resinous lustre, sulphate of iron, formed by decomposition of the sulphuret.

ORIGIN OF THE SPECULAR OXIDE.

Various opinions have been expressed on the mode of filling mineral veins. Some adopting the theory of injection from beneath ; others that of sublimation, and others still an electro-magnetic action, or the separation and transference of particles from the parent rock, into cracks or fissures, by an electrical agency. It is an agency well illustrated by the currents which flow from the positive to negative side of a galvanic battery. If a liquid, as water, for instance, is acted upon by the current, it is decomposed, and the oxygen is found at, or transferred to, the positive pole. To deny such an agency in the filling of veins in all cases, would certainly be wrong; but to attribute the filling of *all* veins to that agency, is equally wrong. Now, experiment clearly proves that the most common mineral substances resist entirely the action of this form of electricity, except under certain conditions. All bodies, in a solid state belong to this class; *fluidity* is an essential condition. This, it is true, may be an aqueous or igneous fluidity. If there is an open fissure filled with water, or any fluid, holding, in solution, mineral matter, it may be deposited or separated from it by galvanic agency. It would appear as an essential condition that a fissure should previously exist. Now, if we suppose igneous fluidity, either of the rock or the mineral in question, or both, it may be galena, or iron, as either have a condition which is incompatible with the formation of a fissure, so long as fluidity exists; or we have a condition in which it becomes unnecessary to call on the aid of an electro-motive power. If the rock is in a state of fusion, no fissure can be formed, into which a metallic substance can be transferred, so long as that condition exists; and when it becomes solid, it loses the essential condition requisite for electromotive action; but while it is in this state of igneous fusion, the particles are in a state which are favorable for movements in obedience to the power of attraction; and hence, masses of mineral matter may, under this condition, form, but the masses are not veins. Again, if the mineral itself is in a state of igneous fusion, and there is a fissure to receive it, then the very power which caused this fusion, is adequate to the filling of it, either by injection, while in a melted state, or by sublimation.

It will be observed that the great objection to the filling of veins by electro-magnetic agency, is, the want of a state in which that agent can exert its powers, that condition or state being one of liquidity; so long, therefore, as a substance is solid, or in an acriform state, it is just so long unacted upon by this agent.* Besides, in favor of igneous agency in the filling of veins, we have many positive examples in the case of dykes of green-stone, lava, &c.

If the above is true, we may conceive that the error comes from the general and exclusive character of the theory. The filling of a vein, in a certain sense, may be, in part, the result of galvanic agency; but it must, from the nature of the case, be confined to the *separation* or decomposition of materials already in the vein; for instance, the salts of silver being in solution, may be decomposed, and pure silver may be deposited on the wood and other materials in the mine. This has occurred in some of the abandoned pits of mines which were filled with water, in which ladders and other implements were left. But this is a result quite different from the original action, when the vein was filled; and in all the experiments yet published to illustrate this process by galvanic agency, the analogy of the two cases is quite obscure, if it does not totally fail, and the result amounts to but little more than the decomposition of some of the materials held in solution by the water filling the vein, and does not go so far as to explain how the materials got there in the first place.

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*Thus, water, though decomposed by galvanism, is not at all acted upon when frozen, or in a solid state.

MAGNETIC OXIDE OF ST. LAWRENCE AND JEFFERSON COUNTIES.

In the southeastern part of St. Lawrence, the great beds of limestone disappear, and along with them, the specular oxide. In their places we find a granite, approaching in its character to the hypersthene rock, with its usual associate, the magnetic oxide. The geological structure of this region is much like that of the eastern part of Essex, and the southern part of Clinton, and the probability is, that when the country is cleared, there will be found a similar mineral district. We already know of several veins of the magnetic oxide. One of these has been noticed in one of the preceding reports. It is known as the Chamont bed, and was explored to some extent, twenty years ago. It is about 4 miles west from the point where the Albany road crosses the Oswegatchie. It is situated near the road, and traverses a ridge or hill, about 100 feet high. A portion of this hill is occupied by the ore mixed with flint, varying in proportions, from 50 to 80 per cent of iron. It is black, and resembles the Palmer ore. It is described by Dr. Ambler, of Rossie, who visited the locality last fall, as a complete "pepper and salt mixture," which we may understand as consisting of fine grains of gray quartz and black particles of iron.

The direction of the ore is nearly east and west, and the richest portion is on the southern declivity. It is in a gneiss rock, whose strata are nearly vertical, but whose dip is to the west. It is highly magnetic.

The quality of this ore has not been sufficiently tested. Nothing in it appears injurious, and the probability is, that it will prove valuable.

Near the locality is good water power and abundance of fuel. Besides the eastern ores, as noticed above, in the primary region of Jefferson county, Alexandria furnishes a few localities of the magnetic oxide. These localities are limited in extent, furnish a bright, shining ore when recently fractured, and have been called, erroneously, specular oxide. Those varieties of ore which I have seen, are similar to those which are known in other places as making a hard iron.

MAGNETIC ORE OF ESSEX AND WARREN COUNTIES.

Before concluding my account of the ores of the Second Geological District, I would not omit noticing a mineral district in the neighborhood of Brant lake, and a vein of valuable ore in Schroon.

The first locality is on the Ellis tract, in Hague. It is a vein of ore about 2 feet wide at the surface, runs north and south, and dips to the east. The accompanying rock is hornblende, much stained with the oxide of iron. It is highly magnetic, fine granular, free from rock, and upon the whole looks like good ore.

Another collection of ore occurs 3 miles north of Brant lake, in a region called *Desolate*. It is from 8 to 10 rods in length, and about 10 feet thick. The ore is fine granular, and compact, stained slightly on the surface by decomposed pyrites. It appears like a valuable furnace ore.

In Schroon, on the land of Mr. Harris, is a *vein of magnetic oxide*, 6 or 7 feet wide, and which may be traced a number of rods. It is on the west side of Paradox lake. It is a beautiful, coarse grained ore, mixed with a very small quantity of flint. It is the purest ore which I have yet seen in that particular neighborhood, and is well worthy of attention.

Another vein arises on the east side of Paradox; it is only about 18 inches wide, and dips too much into the mountain to be explored to advantage.

The Roberts vein, in Warrensburgh on lot No. 80, has been noticed in the former reports. It is about 4 feet wide, and increases in width as it extends downwards.

Notwithstanding all that has been said of the ores of iron in the Second Geological District, I still consider the accounts to be yet incomplete. I have lost no opportunity for observation on this important substance, and have gathered from others those facts which are essential to the completion of our information concerning them.

We may sum up, briefly, our present knowledge of the ores of iron, from which we shall perceive more clearly the value and amount of this mineral in the northern section.

1*st*. *The Clintonville Mineral District.*—In this, I have described 12 veins, 10 of which supply ore to forges for the manufacture of bar iron; and it is well known that the iron is of the best quality.

2*d*. *The Moriah Mineral District*,—in which we may enumerate, also, 10 or 12 veins; as a whole, they are wider and are capable of furnishing more ore than those of Clintonville; some of them are equal in quality to the best, others are inferior and produced a brittle iron.

3*d*. *The Newcomb Mineral District.*—The magnificent veins of this district have been fully described. It will be seen on inspection that the whole width of 3 veins amount to, at least, 1,484 feet.

4*th*. *The Schroon Mineral District.*—This has been explored to a less extent than the preceding. There is no doubt but it will prove productive in iron ores, and the facilities for reducing remarkably good. Thus, the falls on the Schroon river at or near Mr. I. Griffins, in Chester, present very superior advantages for the location of a forge or a furnace. Schroon lake and river are boatable above and below the falls. The state of the river below the falls gives access to the Brant Lake district, a distance of 6 or 7 miles.

5*th*.—Another mineral district exists in Duane, in Franklin county, but not yet examined.

6*th*.—*The mineral districts* of St. Lawrence, in the southeastern part of the county, to which the Chamont ore and the vein in township No. 10 belongs; and another in the adjacent wilderness, whose locality is known only to a few.

7*th*.—*The region of the* specular ore constitutes another mineral district of great importance. The amount of ore belonging to this species cannot be estimated so accurately at present as the others, but may be set down as inexhaustible in the present generation.

It is possible there is another mineral district a few miles west of Plattsburgh. The only fact, however, known to me, is the occurrence of a vein of magnetic oxide in that region. This part of my district I hope to explore the next season. We have, as will be seen, seven distinct mineral districts in the northern counties, each of which are capable of supplying a vast amount of ore. Of these ores, it is to be considered that they possess, in themselves, qualities which will enable a scientific manufacturer to convert them into the best of iron and steel. Of this, there is no doubt. Whether it is as profitable to embark in the manufacture of refined iron and the best varieties of steel as to continue to make the ordinary bar iron, is another question; but that the ores can be converted into them as economically as those of any country, (the value of labor being the same) we consider established.

JEFFERSON COUNTY.

The geology of Jefferson county is quite simple and free from any obscure points, so far, at least, as it regards the order of superposition of its rocks. In speaking of its geology, brevity will be consulted, for the reason that in my next report I shall, necessarily, give a detailed account of it. It will be quite unnecessary to speak of the character of the surface or of the soil. Few counties are better known than this. It is celebrated for its agricultural productions, the excellencies of which are owing, partly to its limestones and argillaceous slates, which undergo a slow decomposition and furnish the elements of a valuable soil.

A general division of the rocks of this county may be made as follows: 1st. The primary class. They are confined mostly to the eastern towns, Wilna and Antwerp; though a portion of Alexandria, all of Wells island and a part of Grindstone island are also of this class. The primary rocks are a gray granite and gneiss, a white granular limestone and hornblende. They are associated together more or less, though there are tracts over which one or the other may extend to the exclusion of all the others; thus, in Antwerp, there is an extended field of primary limestone, and in Alexandria, granite; though Wells island and a large portion of the shore opposite the island is hornblende and gneiss, with scarcely any limestone. Besides the primitive rocks just noticed is one composed of a mixture of serpentine and granular limestone, forming what is frequently called *Verd Antique*. To this I may subjoin *Rensselaerite*, which frequently occurs in thick, heavy beds in connexion with the above.

I am the more disposed to notice the Rensselaerite, in consequence of the use which has been made of it in agriculture as a substitute for plaster, or rather, it was declared to be true plaster, and sold as such. It was a gross imposition and fraud upon those who purchased it: for it was distinctly pronounced entirely unfit for the purposes of agriculture, and as being a stone, different in composition from gypsum. The Rensselaerite, in colour, varies from nearly a pure white to jet black; passing through the several shades of grey, yellowish and smoky grey to black. It is soft, and on the surface may be scratched by the nail; the interior is harder. The structure is generally compact, though sometimes, coarsely fibrous or columnar; fibres or columns diverging from a centre. It is the rock frequently employed for inkstands. The white and finely compact variety is a beautiful substance when polished; when cut thin it is translucent and closely resembles porcelain. The black variety, also, when polished, is handsome and worthy of a place in a cabinet. This rock is generally associated with the primary limestone and serpentine. It hardens by heat like the common soapstone for which it had been mistaken, but may be employed for the same purposes. It may be easily distinguished from it by its hardness; *soapstone* or *steatite* is uniformly soft throughout its mass; whereas, *Rensselaerite*, though it may be soft on the outside, yet, is much harder than steatite on a recent fracture.

Lying unconformably upon the primary is the Potsdam sandstone. It is therefore next in the series. It is a firmer rock, more crystalline and less porous than the same rock in St. Lawrence, and especially that belonging to Potsdam. It is particularly well characterized on the road leading from Carthage to Antwerp. In many places it is broken up and fractured; it everywhere exhibits an abraded surface. The abrasions furnish many instances in which the rock is worn through; or ground away down to the primary rocks beneath. We have evidence of this in the masses of the conglomerate, which is the lower layer, still adhering in small masses to the primary, or which are only a few feet in diameter; their hardness enabling them to resist the abrading action. An instance may be seen near the Oxbow, on the road leading to the Pulpit rock; a remarkable pot hole which has already been mentioned.

This rock furnishes in no place the vestige of any metalliferous product, except what occurs at its junction with the primary; or it is not itself in any portion of the Second Geological District a bearer of the metals. It furnishes, however, a valuable building material; and when porous and uncrystalline it is an excellent stone for resisting heat.

The extent of surface which is occupied by the Potsdam sandstone may be defined by drawing a line from, or near Carthage to Perch lake, and thence to the Oxbow, by Theresa falls. There are, however, on the east side of this line many broken masses of sandstone, but none which are continuous for any considerable extent. Another portion of this rock appears at French creek; it constitutes a part of Grindstone island. This rock is necessarily characterized by its position and mineral structure; as the only fossil which abounds in it is the *lingula ovata,* and large portions of it are entirely destitute even of this. But it may be considered as a characteristic fossil wherever it appears. It is found in the granular and friable masses one mile east of French creek on the road to Depeauville. This fossil, too, is well known to occur at Keesville; it is therefore widely distributed. It is an extremely thin, small shell, and hence easily escapes notice unless it is particularly sought for. This circumstance indicates a great scarcity of lime in the waters from which the rock was deposited, or a great scarcity of food; for we find that in our fresh water lakes those unios or other genera of animals, if the waters are free from lime, have always their delicate shells; whereas, in those which are highly charged with lime they are thick and heavy.

In proceeding upwards we next meet with a thin mass, composed of about equal proportions of carbonate of lime and sandstone; and which is filled with marine plants. It has received the name of *fucoidal mass.* It merits this distinction, for it uniformly occupies this position; it is evident too, that an important change had commenced in the nature of the earthy materials. Previously, no fossil of this kind had appeared; the waters of the ocean had been too much troubled to permit the growth of sea weeds on its bottom; but at this period an abundance suddenly appears in the waters, showing thereby a quiet, settled condition; and moreover, an accession of matter from a new source, viz: carbonate of lime.

This mass varies from 2 to 10 feet in thickness. It appears at the summit of the hill one mile east of French creek. It was uncovered on repairing the road at this place. The lingula ovata may be found just below in the friable sandstone, lying by the roadside. Though the fucoidal mass is very thin, comparatively, still it is a very constant rock, and is rarely absent; thus it is found on Lake Champlain at numerous places, bearing precisely the same fossil.

The next rock in succession is the *calciferous sandrock* of Prof. Eaton, as its name indicates; it is a sandstone, having carbonate of lime in sufficient quantity to effervesce with acids. It is well developed at Chamont, and furnishes excellent blocks which are transported to Oswego for the public works. The upper portion may be the Mohawk limestone. It is a very durable rock, stands the weather remarkably, and is truly one of the most valuable building materials in the State. Where the series of rocks are complete, the next one in succession is the Birdseye. In relation to this, I am not fully satisfied whether it appears in Jefferson county or not. There is a limestone however which I have called the Birdseye between French creek and Depeauville. It is quite compact, breaks with a fracture somewhat conchoidal, but is destitute of animal remains. My doubts on this subject arise from not being able to refer to the specimens of this rock which I collected for illustration. In the rock which occurs between the two places just named, we have the first of the water limes. Before exposure to atmospheric agents, this rock differs very little in appearance from the Birdseye; only it is not so compact and in some parts, is sandy and friable. On weathering, however, it turns yellowish and appears in contrast to the adjacent rock. It is entirely destitute of fossils of any kind. But the effect of the weather upon it, together with the presence of *sulphate of strontian* and *calcareous spar*, are characters sufficiently definite to distinguish it from other rocks in the vicinity. I have called this the water lime rock of Depeauville; or *Depeauville water lime*, as it was at this place it was first prepared for use.

There is a difference of opinion as it regards its value for water lime; I conceive this to arise from a want of a proper selection from the rock for burning. Those portions which are sandy, contain evidently too much silex for mortar. Whenever, therefore, such portions have been used, there has been a disappointment.

This rock has not been analyzed, but it probably contains silex, a little alumine and oxide of iron, in addition to the carbonate of lime. If I am right in the opinion just expressed, the Depeauville water lime occurs in beds, or overlies the Birdseye. Its beds are rarely more than 10 feet thick at those places where it is quarried. The Birdseye extends north to La Fargeville, preserving much the same character as in other places. It also at this last place contains a few important fossils which have not been examined. At this place too, the rock exhibits those straight columnar masses which appear in the western limestone, which are produced by the crystallization of sulphate of magnesia or some other salt. Probably it is the lowest rock in which this appearance is known.

Trenton Limestone.

This is the most extensive rock in Jefferson county. It is the gray variety, interlaminated with seams of slate of a darker colour than the limestone. At the surface in many places, it is separated into innumerable roundish pieces by weathering. These are the hardest portions of the rock, and seem to have been produced by molecular atttraction, while the rock was in the progress of consolidation. It is generally loaded with organic remains, as several species of Orthoceras, Strophomena, Delthyris, Orthis, Lingulæ, Bellerophon, Isotelus, Asaphus, Calymenæ, Columnariæ, Cyathophylum, &c. These genera constitute but a small part of the fossils which are found in the rock.

This rock extends across the country from east to west, or from Champion to Sacket's-Harbor. It is especially well developed in Watertown, Brownville and Sacket's-Harbor, Pillar Point, Adams and Rutland.

It is not the repository of any metals, so far as is known in this county. It is, however, a valuable rock as a building stone in its rough state, and the compact and sound portions form valuable marble. It is an excellent substratum for soil. It not only furnishes the elements of a good soil, but one which produces a somewhat peculiar vegetation. Thus the neighborhood of Watertown produces many rare botanical species which are confined to those places underlaid by this limestone.

This rock is remarkable for its cavernous structure. Several extensive caves occur in it, in the vicinity of Watertown and Brownville. These abound in beautiful stalagmites in which we frequently find the bones of bats. These subterranean passages were evidently formed by the action of running water. When these passages had been formed, much as we now find them, the pereolation of water through the roof, containing in solution carbonate of lime, commenced, a portion of which fell on the limestone beneath and then accumulating, it slowly deposited the remaining carbonate of lime on the floor. The external forms of these concreted masses are various. Some are in crystalline nodules, others are spread out in sheets which are waved on their upper surface, an appearance communicated by the slight ripple of the water from which the deposit took place. In these masses we find many cavities, and with fine yellow crystals. In fine, the caves of Watertown are well worth the attention of the traveller.

The following report has been furnished by professor F. N. Benedict, of the University of Vermont. It will, I have no doubt, be considered an important addition to the information which has already been communicated through the Legislature to the people.

It bears upon the face of it great accuracy, and a patient investigation of the subjects upon which it treats. It will be perceived that it gives an impartial view of the measurements of the mountains of the northern section of the State, and places in their true light the relative value of the barometrical and trigonometrical measurements in general. In relation to the discrepancies which appear between us I would remark, 1st, that Professor Benedict's instruments are more perfect than those I used. In the 2d place, we have invariably found that the greatest differences appear with Burlington as a station than with those at Albany, N. Y. which seems to result from the difference of time in the changes of atmospheric pressure. It is proper also to add that the observations made upon White-Face, in 1837, by myself and Mr. Hall, were at a time the most unfavorable for accuracy, being made at or near the time of the autumnal equinox, and just at the commencement of a storm; a a time when the fluctuations of the barometer are greater than at other periods. I have not at any time claimed a greater accuracy in measurement than my observations would warrant. It has been my wish that they should be received as approximations to the truth, hoping also that the attention of the public might be called thereby to the subject, that individuals might be induced to take it up and furnish a portion of the materials for a final result; for it is certain that the work of determining the height of the mountains, even of Essex county, is too great to be accomplished by one individual during the period of the survey.

"*Burlington,* 13 *Feb.* 1840.

To Prof. E. EMMONS.

DEAR SIR—Agreeably with your request I visited at two different times, in the months of July and August last, the sources of the Hudson, Saranac and Racket rivers, with the view of determining the position of that plateau which forms the base of, and extends west of the Adirondack mountains. From the want of time and the requisite angular instruments I was obliged to have recourse exclusively to barometrical measurements.

The instruments used at the two stations were Bunten's mountain barometers, purchased by the University of Vermont, with special reference to their adaptedness to exact observations. These instruments are syphons, with the bores of the two legs made scrupulously equal; thus avoiding erroneous corrections for capillarity. The zero point is near the middle of the scale, and the readings are from that point to the tangents of the two mercurial surfaces. The sum of these gives the observed length of the column. Such is the construction of the vernier that it must be careless reading which would give an error of five hundredths of a millimetre, or about two thousandths of an inch. The thermometer attached is encased in the brass scale which surrounds the tube at its middle. The graduation of both the thermometer and barometer scale is very accurate. A great variety of comparative observations which I have made in connexion with Prof. G. W. Benedict leaves no reasonable doubt of the accuracy of the graduation or uniformity of the tubes.

Of the observations made at Burlington to synchronize with those at the superior stations, those before the 6th of July were made by Prof. G. W. Benedict, whose high standard of accuracy is well known. The elevation of this station is 235 feet above Lake Champlain, as determined and verified by the spirit level, or 325 feet above tide, estimating the elevation of Lake Champlain at 90 feet. The observations at Burlington, after the first of August, were made by my brother, whose carefulness and skill in observing had been tested The elevation of this station above tide was 374 feet, determined by the spirit level as above.

The table below exhibits the notes as they were taken from the instruments, with their respective calculated elevations. To convey a just idea of the agreement or discrepancy of the results, I have presented all that were made, with the exception, I think, of five or six, some of which bore evident marks of faultiness in their observations. The two numbers in the sixth column, corresponding to each date, are the upper and lower readings of the barometer, which are recorded instead of their sum, as furnishing a means of verifying the accuracy of the observations, particularly in reference to the temperature of the mercury, which is liable, without extreme care, to a false indication by the attached thermometer, of a number of degrees. I have ascertained that the condition to be satisfied in order to be assured of accuracy in this respect, for any syphon barometer, is contained in the equation

$$a - b = \mathrm{A} + \mathrm{BT} + \mathrm{C}(v + \mathrm{D});$$

in which a, b, are respectively the upper and lower readings, T the temperature of the mercury as indicated by the attached thermometer, v the distance of the superior mercurial surface, and A, B, C, D, coefficients which differ in different barometers, but are constant in the same. The appropriate conditions for the barometers No. 275 and No. 366, the former of which was used at Burlington, I have found to be, respectively, $a - b = -2{,}17 + 0{,}107\,\mathrm{T}$, ... (1)
and $a' - b' = 35{,}14 + 0{,}107\,\mathrm{T}' - 0{,}004\,(402 - a)$. .... (2)
These formulæ have been employed in rejecting some of the faulty observations referred to above, and, assuming the correctness of T, in correcting the elevations of Lake Colden and Mt. Marcy, where the conditions expressed in (2) were not satisfactorily answered.

As is not uncommon, even with good instruments, the column of No. 275 exceeded that of No. 366 by 2.50 millemetres, which I consequently added to the sum of the upper and lower readings of the superior barometer. This difference between the columns is a mean derived from a comparison of more than 100 sets of observations, in which care was taken to secure as great a degree of uniformity in the temperatures of the atmosphere and mercury as possible, and to exclude all causes of change in the columns which were not equally operative in each, except those depending upon peculiarities in the constructions of the instruments themselves.

Various experiments, which it is needless at present to detail, suggested the possibility that a part at least of this difference of columns might arise from a small portion of air in the summit of the tube of No. 366; and that consequently the correction above, instead of being constant, would depend upon the temperature and volume of the included air. On this hypothesis, which however I was prevented from verifying to the extent desired, by the loss of one of the barometers, I made the correction $(451 - a) \times 0{,}021 \times (16 - \mathrm{T})$, in metres, which is additive or substractive according as T is less or greater than 16. But to whatever extent this correction might differ from the truth, the correction produced much more uniformity in the results of observations made at any one point than appeared without it. This correction likewise provides, to some extent at least, for any error which possibly may exist in the ordinary valuation of the effect of the temperature of the air upon the calculated elevation, or of its hydrometrical state so far as it may be indicated by this temperature, which at the superior station differs but little from T. The formula therefore used is $h = p + (451 - a) \times 0{,}021 \times (16 - T)$, in which h represents the true difference of level between the stations in metres, p this difference, according to the tables of Oltmanns, a the upper reading of the superior barometer, and T the temperature indicated by its attached thermometer.

The additional correction which I applied to the elevations of Lake Colden and Mt. Marcy is $12(-m + m' + n - n')$, in which m, m', are the first members of the conditions (1), (2); and n, n', the second.

A slight correction for capillarity, of about three-tenths of a millimetre, I deducted from the correction 2.50 in the 7 observations made during my first visit.

Oltmanns' tables have been employed in these calculations, which have furnished, in the cases in which I have compared them, the same results as those derived from La Place's theorem. An example of this agreement appears in the calculation of the height of Mt. Marcy. I have not seen the construction of these tables, but conjecture from this agreement, that La Place's theorem was made their base. Humboldt, who made his calculations according to the theorem, mentions the harmony of his results with those of the same heights by Prof. Oltmanns, and pronounces the tables of the latter to be "of the utmost precision."

TABLE OF BAROMETRICAL OBSERVATIONS AND ALTITUDES.

Elevation of Lower Saranac Lake.

		Att.	Det.	Obs.	Alt. in Eng. feet.	Deviation from mean.
July 6th, 1839.						
1 Burlington,	8h 50′ p m	20.4	15.5	751.75		
Lake, ...	" "	14.6	14.5	720.07	1528.37	+1.06
Aug. 28.						
2 Burlington,	6h 30′ p m	16.4	13	378.30		
				378.70		
Lake, ...	6h 30′ p m	11.	10.6	379.75		
				343.54	1527.80	+0.49
3 Burlington,	7h 10′ p m	15.3	11.6	378.35		
				378.75		
Lake, ...	7h 0′ p m	10.	8.9	379.70		
				343.60	1526.41	—0.90
Aug. 29.						
4 Burlington,	5h 56′ a m	10.2	5.3	379.05		
				380.15		
Lake, ...	6h 0′ a m	4.1	3.3	380.40		
				344.90	1526.67	—0.64
Mean elevation above tide, ...					1527.31	

Upper Saranac Lake.

July 6.					
5 Burlington,	12h 50′ p m	20.2	18.3	755.70	
Lake, ...	1h 0′ p m	15.	15.	378.30	
				341.60	1567.58

Stony Ponds.

July 6.					
Burlington,	10h 20′ a m	20.1	19.8	756.00	
do	11h 50′ a m	20.1	20.6	755.70	
6 Means, ...	11h 5′ a m	20.1	20.2	755.85	
Ponds, ...	11h 0′ a m	18.	18.	721.15	1536.36

Foot of Racket-Falls, about 8 miles below Long Lake.

July 6.					
Burlington,	6h 20′ a m	20.1	16.	756.70	
Falls, ...	6h 15′ a m	11.	11.	721.25	
7 Falls, ...	6h 30′ a m	11.	11.	721.20	
Means, ...	6h 22′ a m	11.	11.	721.22	1538.84

Long Lake, Hamilton County.

		Att.	Det.	Obs.	Elevation above tide.	Deviation fr'm mean.
July 3.						
8 Burlington,	11h 30′ a m	23.8	23.2	750.15	1575.03	—0.93
	11h 38′ a m	22.	22.	376.10		
Lake, ...				338.60		
9 Burlington,	12h 10′ p m	23.9	24.2	749.65	1566.83	—9.13
Lake, ...	" "	22.5	22.5	376.00		
				338.50		
10 Burlington,	12h 33′ p m	24.	25.5	749.55	1566.83	—9.13
Lake, ...	12h 40′ p m	23.	23.	376.00		
				338.50		
Aug. 22.						
11 Burlington,	1h 28′ p m	27.9	26.5	377.10		
				376.20	1573.80	—2.16
Lake, ...	1h 30′ p m	25.7	24.7	378.10		
				340.30		
Aug. 24.						
12 Burlington,	2h 2′ p m	27.6	29.6	377.20		
				376.40	1587.53	+11.57
Lake, ...	2h 0′ p m	25.6	25.	378.25		
				340.50		
13 Burlington,	3h 2′ p m	28.	28.9	377.00		
				376.15	1590.17	+14.21
Lake, ...	3h 0′ p m	26.4	24.7	378.07		
				340.10		
14 Burlington,	4h 2′ p m	27.2	27.	376.70		
				376.00	1585.53	+9.57
Lake, ...	4h 0′ p m	25.2	24.4	377.80		
				340.00		
15 Burlington,	5h 7′ p m	26.7	24.	376.70		
				375.90	1579.28	+3.32
Lake, ...	5h 0′ p m	23.6	23.	377.75		
				340.00		
Aug. 20.						
16 Burlington,	1h 24′ p m	27.7	27.9	378.90		
				378.00	1573.61	—2.35
Lake, ...	1h 30′ p m	28.1	27.2	380.20		
				342.10		
17 Burlington,	1h 54′ p m	28.	27.7	378.90		
				378.00	1572.18	—3.78
Lake, ...	2h 0′ p m	27.8	26.1	380.10		
				342.10		
18 Burlington,	6h 24′ p m	28.1	23.3	378.50		
				377.40	1579.49	+3.53

			Att.	Det.	Obs.	Elevation above tide.	Doviation fr'm mean.
	Lake, ...	6h 30′ p m	23.9	23.9	379.23		
					341.60		
19	Burlington,	6h 54′ p m	28.7	23.3	378.45		
					377.40	1561.21	—14.75
	Lake, ...	7h 0′ p m	20.5	21.1	379.00		
					341.80		
	Mean elevation above tide,					1575.96	

Forked Lake.

			Att.	Det.	Obs.	Elevation above tide.	Doviation fr'm mean.
	Aug. 21.						
20	Burlington,	10h 26′ p m	25.	26.1	378.40		
					377.90	1717.66	+13.14
	Lake, ...	10h 30′ p m	23.5	22.4	378.10		
					340.50		
21	Burlington,	1h 26′ p m	28.6	28.6	378.20		
					377.30	1694.33	—10.19
	Lake, ...	1h 30′ p m	28.	26.2	377.93		
					339.95		
	Aug. 26.						
22	Burlington,	6h 36′ p m	22.	18.1	275.50		
					375.30	1694.36	—10.16
	Lake, ...	6h 30′ p m	21.7	21.3	375.30		
					337.85		
23	Burlington,	7h 6′ p m	22.	18.1	375.40		
					375.30	1711.75	+7.23
	Lake, ...	7h 0′ p m	21.5	21.1	375.00		
					337.60		
	Mean elevation above tide,					1704.52	

Elevation of Racket above Forked Lake.

The observations taken with the same barometer.

			Att.	Det.	Obs.	Elevation above tide.	Doviation fr'm mean.
	Aug. 27.						
24	Forked L..	6h 25′ a m	20.	18.9	374.10		
					337.00		
	Racket L..	6h 0′ a m	20.	19.5	373.65		
					336.75	26.98	
	Add elevation of Racket above Forked Lake,..					1704.52	
	Elevation of Racket Lake above tide, ...					1731.50	

Owl's Head, about 4 miles northwest of the head of Long Lake.

			Att.	Det.	Obs.	Elevation above tide.	Doviation fr'm mean.
	Aug. 22.						
25	Burlington,	10h 27′ a m	24.3	24.	377.50		
					377.10	2706.13	+4.52
	Owl's Head	10h 30′ a m	21.	20.5	364.10		
					326.92		

Owl's Head above Long Lake.

With the same barometer.

			Att.	Det.	Obs.	Elevation above tide.	Deviatiom fr'm mean.
	Aug. 22.						
26	Long Lake,	1h 30′ p m	25.7	24.7	378.10		
					340.30		
	Owl's Head	11h 30′ a m	22.	22.2	363.90		
					326.80	1121.13	
	Add elevation of Long Lake above tide,					1575.96	
	Elevation above tide,					2697.09	
	Mean of the above results,					2701.61	—4.52

Rich Lake.

			Att.	Det.	Obs.	Elevation above tide.	Deviatiom fr'm mean.
	Aug. 19.						
27	Burlington,	6h 22′ p m	28.1	23.7	379.30		
					379.35	1547.20	+0.05
	Lake,	6h 30′ p m	20.9	20.	380.60		
					343.30		
28	Burlington,	6h 52′ p m	28.1	23.9	379.30		
					379.40	1547.10	—0.05
	Lake,	7h 0′ p m	19.8	19.1	380.50		
					343.40		
	Mean elevation above tide,					1547.15	

Newcomb Lake.

			Att.	Det.	Obs.	Elevation above tide.	Deviatiom fr'm mean.
	Aug. 19.						
	Burlington,	1h 22′ p m	26.6	26.5	379.70		
					379.00		
29	Lake,	1h 15′ p m	23.8	22.8	379.10		
					341.55	1698.98	

Lake Sanford.

			Att.	Det.	Obs.	Elevation above tide.	Deviatiom fr'm mean.
	Aug. 15.						
	Burlington,	6h 14′ p m	23.6	19.4	380.80		
					380.40		
	Burlington,	6h 44′ p m	23.1	19.3	380.70		
					380.24		
	Means,	6h 29′ p m	23.4	19.3	380.75		
					380.32		
30	Lake,	6h 30′ p m	16.4	16.4	379.30		
					342.57	1719.26	+7.29
	Burlington,	6h 44′ p m	23.1	19.	380.70		
					380.24		
31	Lake,	6h 45′ p m	16.2	16.	379.30		
					342.65	1710.58	—1.39
	Burlington,	6h 44′ p m	23.1	19.	380.70		
					380.24		

		Att.	Det.	Obs.	Elevation above tide.	Deviation fr'm mean.
Burlington,	7h 14′ p m	22.9	18.8	380.70		
				380.20		
Means, ...	6h 59′ p m	23.	18.9	380.70		
				380.22	1701.58	—10.39
32 Lake, ...	7h 0′ p m	15.9	15.5	379.40		
				342.65		
Aug. 16.						
Burlington,	3h 16′ p m	24.1	23.5	380.20		
				379.70		
33 Lake, ...	3h 30′ p m	20.2	19.7	379.25		
				342.30	1704.93	—7.04
Burlington,	6h 46′ p m	23.8	19.8	379.90		
				379.40		
34 Lake, ...	6h 30′ p m	17.	16.9	378.50		
				341.80	1711.89	+0.08
Burlington,	7h 16′ p m	23.7	19.7	380.00		
				379.50		
35 Lake, ...	7h 0′ p m	16.3	16.4	378.45		
				341.80	1723.57	+11.60
Mean elevation above tide..................					1711.97	

Lake Henderson.

Aug. 19.						
36 Burlington,	1h 44′ p m	23.7	24.	381.20		
				380.70	1821.96	—4.56
Lake, ...	1h 45′ p m	22.5	22.3	379.20		
				341.75		
37 Burlington,	2h 14′ p m	24.8	23.9	381.20		
				380.70	1825.15	—1.37
Lake, ...	2h 15′ p m	23.4	22.8	379.25		
				341.60		
38 Burlington,	3h 0′ p m	23.9	23.9	381.15		
				380.50	1832.45	+5.93
Lake, ...	3h 0′ p m	24	23.3	379.00		
				341.50		
Mean elevation above tide,..................					1826.52	

Lake Colden.

Aug. 14.						
39 Burlington,	6h 12′ p m	23.7	19.	381.30		
				380.80	2739.50	+3.19
Lake, ...	6h 0′ p m	16.	15.8	367.35		
				329.50		
40 Burlington,	6h 42′ p m	22.7	18.9	381.20		
				380.90	2738.85	+5.52

			Att.	Det.	Obs.	Elevation above tide.	Deviation fr'm mean.
	Lake, ----	6h 45′ p m	15.2	14.8	367.30		
					329.50		
41	Burlington,	7h 0′ p m	22.5	18.	381.20		
					380.90	2730.25	—8.79
	Lake, ----	7h 0′ p m	14.9	14.4	367.30		
					329.60		
	Mean elevation above tide, ------------------					2771.53	
	Adirondack Pass.						
	Aug. 12.						
42	L. Hend's'n	1h 30′ p m	15.	15.	376.55		
					340.10		
	Pass, -----	11h 30′ a m	13.4	13.4	364.10		
					327.65	2817.24	
	Clear Pond—Johnson's.						
	June 29.						
43	Burlington,	6h 5′ p m	22.5	24.	751.60	1869.52	—0.17
	Pond, ----	6h 10′ p m	20.5	20.3	373.60		
					336.30		
44	Burlington,	7h 0′ p m	22.4	22.2	752.50	1877.66	+7.97
	Pond, ----	7h 2′ p m	19.4	18.3	373.65		
					336.60		
45	Burlington,	6h 5′ p m	22.5	24.	751.60	1865.49	—4.20
	Pond, ----	6h 10′ p m	20.5	20.3	375.90		
					336.90		
46	Burlington,	7h 0′ p m	22.4	22.2	752.50	1866.08	—3.61
	Pond, ----	7h 2′ p m	19.4	18.3	376.00		
					337.25		
	Mean elevation above tide, ------------------					1869.69	
	Mount-Marcy.						
	Aug. 14.						
47	Burlington,	6h 10′ a m	18.	13.9	381.40		
					381.60	5325.29	—12.22
	Mt. ------	6h 7′ a m	6.6	6.6	334.90		
					299.40		
48	Burlington,	6h 40′ a m	17.9	14.9	381.60		
					381.80		
	Mt. ------	6h 30′ a m	7.	6.6	340.90		
					299.40	5339.93	+2.42
	Mt. ------	7h 0′ a m	7.5	7.	335.00		
					299.50		
	Means, ---	6h 45′ a m	7.2	6.8	334.93		
					299.43		
	Burlington,	7h 10′ a m	18.	15.2	381.70		
					381.90		

		Att.	Det.	Obs.	Elevation above tide.	Deviation fr'm mean.
49 Mt.	7h 0′ a m	7.5	7.	335.00		
				299.50	5347.31	+9.80
Mt.	7h 30′ a m	8.	7.5	335.05		
				299.50		
Mean,	7h 15′ a m	7.7	7.2	335.02		
				299.50		
Mean elevation above tide,					5337.51	
Mean of these observations, calculated by La Place's formula.						
50		18.	14.7	381.57		
				381.77	5344.69	
		7.2	6.9	334.95		
				299.44		

The singular elevation of Mount Marcy, distinguishes it from the other objects of calculation in the above table, and entitles it to particular consideration, more especially so, as some discrepancy exists between the measurements that have hitherto been made.

Passing over every other personal circumstance connected with my ascent, I cannot but remark, that through the characteristic liberality of the Hon. A. McIntyre, and the attentions of his agent, Mr. Porteus, I was supplied with every thing needful to my comfort as a guest, and the object of my visit materially promoted.

The following table embraces all the observations that were made during my stay on the summit. The reductions of the mercurial columns were made from a table executed by Prof. G. W. Benedict, with great care and precision, which has regard to the effect of temperature upon the brass scale, as well as upon the column of mercury.

	Times of observation.	*Alt. Ther.*	*Det. Ther.*	*Cor. Columns.*
1	Aug. 14. 6h 7′ a m	6.6	6.6	633.67
2	do 6h 30′ a m	7.0	6.6	633.57
3	do 7h 0′ a m	7.5	7.0	633.72
4	do 7h 30′ a m	8.0	7.5	633.71
5	do 8h 0′ a m	8.0	7.8	633.76
6	do 8h 30′ a m	8.5	8.3	633.90
7	do 9h 0′ a m		9.2	634.15
8	do 9h 30′ a m	9.8	9.5	634.05
9	do 10h 0′ a m	9.9	9.5	634.04
10	do 10h 30′ a m	9.8	9.5	633.80

The wind, during the whole period, was strong and uniform from the north. Until about 8 o'clock, the summit was swept by a cloud of of rain and vapor. This gradually disappeared, producing rapid alternations of storm and sunshine. About 10 o'clock the sky became almost entirely clear.

It appears from the above notes, that the whole range of the column, embracing the slight but unavoidable errors of observation, is less than 6 tenths of a millimétre, or less than three thousandths of an inch.—The uniformity of the force and direction of the wind, is a circumstance favorable to correct results not always found on mountain peaks, which are liable to be swept by variable and conflicting currents.

From some misunderstanding in regard to time, and from not attaining the summit as early as I anticipated, only three sets of observations synchronized sufficiently to be employed. The remainder, however, answered the important purpose of verifying those that were taken.

The following are the observations made at Burlington :

	Dates.		Att. Ther.	Det. Ther.	Cor. columns.		
1	Aug. 14,	5h 10′ a m	18.0	13.7	760.43	Wind northeasterly ;	cloudy.
2	do	7h 40′ a m	18.0	13.6	760.53	do	do
3	do	6h 10′ a m	18.0	13.9	760.73	do	do
4	do	6h 40′ a m	17.9	14.9	761.13	do	do
5	do	7h 10′ a m	18.0	15.2	761.33	do	do

From the little time allowed, in my first observation on the summit, for the mercury to acquire the temperature of the air, and for taking the requisite precautions, the result, 47, errs in deficiency. The elevation derived from the three sets is 5337.5 above tide, which differs from the three results only by 12.2 and 10 feet.

According to the barometrical measurement by Mr. Redfield and Prof. Emmons, as given in the New-York Geological Report of 1838, the elevation of this peak is 5,467 feet. The difference between these results is not so considerable as of *itself* to impair confidence essentially in either, and they should therefore be regarded rather in the light of mutual verifications—at least so far as concerns *barometrical* measurement. The justness of this opinion may be inferred from some remarks that may follow. If the circumstances of the two measurements were similar, in regard to the delicacy and exactness of the instruments, the positions of the stations, and the number of observations, the mean of the two should undoubtedly be taken. Not having seen a description of Mr. Redfield's barometers, I can only *conjecture* that they were of the ordinary cistern kind; and if so, the less perfect instruments.

As to the stations, Prof. Emmons had the advantage of being in nearly the same longitude, while mine differed in this respect probably 50 minutes; but they had the disadvantage in their remoteness, mine being about 40 and his 100 miles asunder. The most important circumstance in favor of my result is the number of observations.

The only other measurement of this mountain, which has come to my knowledge, is a trigonometrical one, executed by E. F. Johnson, Esq. a distinguished civil engineer, and published Jan. 30, 1839, in his report to the New-York Legislature, of his survey of a rail-road from Ogdensburgh to Lake Champlain. The altitude of Mount Marcy, according to this result, is 4,907 feet, which is less than the barometrical measurements make it, by 430 to 560 feet. This discrepancy is too considerable to be altogether overlooked.

The fair presumption, as it appears to me, is, that Mr. Johnson *sought* no greater degree of accuracy than was requisite to convey a general idea of its elevation. This may be inferred from the fact that its *exact* determination was a matter of no consequence to the rail-road that he was exploring, the relation between them being remote and incidental. This presumption is strengthened, moreover, from his manner of executing the measurement. His estimating the distance to the mountain from a map, instead of deriving it from an accurately established base, connected with his acknowledged skill in his profession, furnishes abundant evidence that strict topographical accuracy was not his object.

Between what limits, then, may the trigonometrical result be depended upon? Mr. Johnson has deprived his measurement of a requisite essential to confidence as an exact operation, in leaving us totally ignorant of the position in space of his point of observation, of the distance that he actually used, and of the number and values of the angles that he observed. His estimate of *distance*, on the authority of the old survey records of that alpine region, is liable to an error of at least five miles. These surveys are notoriously imperfect—a fact that we might anticipate, in a country where the lands were almost absolutely valueless, and where numerous obstacles, such as local attractions, ponds and mountains, opposed the execution of a survey with even an approximation to accuracy.

Suppose now, that the angles were observed from a point near the University, at an elevation of 360 feet above tide—that the distance of the peak from this station falls between 35 and 45 miles—and that its elevation above tide, according to the trigonometrical measurement, is 4,907 feet. These hypotheses are sufficiently exact to answer our purpose, and from all that appears in Mr. Johnson's description of his method, the ones most favorable to his result. Imagine the elevation to consist of three parts ; the first part that which is intercepted between the levels of tide and the station at Burlington ; the second part, that which is intercepted between the level at Burlington, and a plane that touches the earth's surface at the point of observation ; and the remainder of the elevation, the third part. These three portions, in the order above named, assuming the distance to be 35 miles, are 360, 817 and 3,730 feet. All things else being equal, correct now a supposable error in distance of 5 miles, calling it 40 instead of 35. The first part of the elevation remains constant ; the second part, varying as the square of the distance, is 1,067 feet, and the third part, varying in the simple ratio of the distance, is 4,263 feet. The total elevation based on this last hypothesis of distance, is 5,690 feet, which exceeds my measurement by 341 feet, and the one by Mr. Redfield and Prof. Emmons by 223. An error in distance, therefore, of 5 miles, induces an error of elevation of 783 feet.

To show what error in Mr. Johnson's estimates would produce identity in our results, we will suppose that the distance which formed the base of his calculations was 35 miles, and that the distance necessary to make our results agree, is d. The familiar principles above alluded to furnish the equation,

$$\frac{2d^2}{3} + \frac{3730+d}{35} + 360 - 4907 = 442.$$

This gives the requisite distance d, equal to 37.8 miles. Supposing, therefore, an error in distance of only 2 miles and 8 tenths, a supposition not only possible but probable, our results would become identical.

As I have not learned the distance that Mr. Johnson actually used, it is proper to remark, that if we should assume the distances 40 and 45, instead of 35 and 40, our conclusions would not differ so much from those above, as to vitiate the argument. Using these latter numbers, which are probably somewhat nearer the truth than the former, an error of 5 miles in distance would still induce an error in elevation of 718 feet.

Refraction is another cause of deviation from exactness, of which, however, I shall merely remark in this connection, that it may occasion an error of about 100 feet, and that, too, even after a correction has been applied according to the best authorities.

A discussion of the comparative merits of barometrical and angular measurements of great elevations, would prolong this communication to an unreasonable length. I shall pass over it, therefore, at present, with one or two brief remarks. The barometer and theodolite have their peculiar capabilities and defects; and the exact measurement, by either, of a mountain covered with clouds during the greatest portion of the year, and surrounded by an atmosphere subject to incessant change, demands more perfect instruments and skill in their use, than is generally apprehended.

The chief difficulty that the barometer has to contend with, and one over which it has no direct control, is a want of uniformity in the changes of atmospheric pressure, in different places at corresponding times. As correct observations have been multiplied, more harmony in this respect has been detected than had formerly been supposed. Indeed, this is not the only department in which nature has been held accountable for blunders due to clumsy instruments and unskilful observers. This difficulty, without doubt, exists to such an extent as to impair confidence in single sets of observations at least, with whatever care they may have been made. The atmosphere, whether charged uniformly with vapor or not, must evidently have a strong tendency to equilibrium, and a derangement of it, within moderate distances, must consequently be transient. For this reason, a course of consecutive observations at the same station should always be taken, which will enable the observer to guard against error, either by rejecting all, or selecting those that, in this way, are shown to be worthy of confidence.

The corrections for the hygrometrical state of the atmosphere, are undoubtedly more or less imperfect, although that portion of the error which yet remains unprovided for, I apprehend is comparatively inconsiderable. La Place measures these effects by the temperature of the air, and observes that this hypothesis very nearly satisfies the observations that have hitherto been made. The agreement of my results, where *courses* of observations were taken, intimates with what degree of approximation I have corrected for the changes of the weather. This agreement is particularly worthy of remark in relation to Long lake, where the observations were protracted in time, and the weather singularly variable. But notwithstanding all this, I am free to admit, that these corrections are still less perfect than could be desired.

The theodolite is above the need of eulogium from any one ; but, like every other human invention, it has its proper capabilities and defects. An indispensable condition to the accuracy of angular measurements, is the exact determination of a base line, a work which requires that skill, variety of delicate instruments, time, and means, which, in this country, are not generally at the command of a single individual. Triangulations embracing great extent, have been executed with astonishing precision, and the results of similar measurements, properly conducted, are entitled to the utmost confidence. On the contrary, the angular determinations of high mountains have been comparatively vague. One cause for this difference, consists in the great distances at which mountains are generally observed, and the consequent smallness of the angles of elevation. In this respect, a condition is almost necessarily violated, which was scrupulously satisfied in the surveys just referred to.

The chief source of error in mountain measurements, and one which distinguishes it from horizontal ones, is refraction. This difficulty, growing out of the condition of the air, and independent, therefore, of the instrument, is analagous to the one which the barometrical method is exposed to, with this difference in favor of the latter, that the atmospheric changes going on at both stations may be detected and compared.

Refraction differs, in different countries and at different times, from one fourteenth to one-eighth of the distance, reckoned in minutes. Such being the uncertainty as to the true path of light in low and familiar regions, it must be particularly difficult to follow it with precision through mediums of changing relations, and elevated tracts comparatively unknown. Refraction, too, depends not only upon the affections of the air, but upon the relations of the line of sight with other objects. Every one who has used the spirit level, is aware of the errors that he is exposed to, when, in clear weather, his line of collimation approaches logs and fences or the surface of the ground.

The Peak of Teneriffe, from its great elevation, and the number of times that it has been measured according to both methods, by distinguished observers, is a fair practical example, illustrative of the foregoing remarks, and shows that barometrical measurements are not altogether unworthy of confidence, even when compared with angular ones by the same observers. The following table, as published by Humboldt, exhibits the results :

Geometrical measurements made on land.				
By P. Feuillée,....................	made in	1724,	2,213	toises.
The same result, modified by Bouguer,.	do		2,062	do
By Heberden and Cross, five operations,	do	1752,	2,408	do
By Hernandez,....................	do	1742,	2,658	do
By Borda and Pingré,................	do	1771,	1,742	do
By Borda, ...	do	1776,	1,905	do
Geometrical measurements made under sail.				
By Mannevilette....................	do	1749,	2,000	do
By Borda and Pingré,................	do	1771,	1,701	do
By Churacca, ...	do	1788,	2,193	do
By Johnston,....................			2,023	do
Barometrical measurements, calculated after the formula of La Place.				
By Feuellée and Verguin,............	do	1724,	2,025	do
By Borda, ...	do	1776,	1,976	do
By Lamanon,....................	do	1785,	1,902	do
By Cordier, ...	do	1803,	1,920	do

In view of these measurements, Humboldt makes the following remarks:

" These measures, taken at different periods, vary from 1,700 to 2,600 toises, and, what is remarkable enough, the results obtained by geometrical operations, differ more from each other, than those which were found by the barometer. It has, nevertheless, been extremely wrong to cite this want of harmony as a proof of the uncertainty of all measurements of mountains. Angles, the value of which is determined by imperfect graphometers; bases that have not been levelled, or the length of which has been determined by the log; triangles that give an excessively acute angle at the summit of the mountain; heights of the barometer, without any notice taken of the temperature of the air and of the mercury; unquestionably are not means calculated to lead to accurate results. Of fourteen trigonometrical and barometrical operations above indicated, the four following only can be considered as true measurements:

Borda by trigonometry,	1905	toises.
" means of the barometer,	1976	"
Lamanon, the same,	1902	"
Cordier, do	1920	"

Humboldt's Personal Narrative, vol. 1 and 2, in one. It is worthy of remark that the mean of the five geometrical measurements made on land differs from the extremes by 422 and 493 toises, while the mean of the barometrical measurements differs from the extremes by less than 53 and 59 toises.

It is remarkable, also, that Humboldt, after elaborate discussion with the details of the operations before him, should select but one geometrical result out of 9, and three barometrical ones out of 4, as the most suitable to derive his mean from.

It appears, also, that the range of the differences of the 4 measurements adopted as true ones, is 74 toises, or 3.9 per cent of the whole elevation. This justifies a remark made in an early part of this article, that the two barometrical results should be regarded as accordant; since the difference is only 2.4 per cent of the elevation of the summit above the lower station, which is more than one-third less than Humboldt, considered consistent with reasonable agreement.

The measurements which I have made, although by no means so numerous as could be desired, are sufficient to fix with considerable accuracy the position of that extensive tract of table land interposed between Lakes Ontario and Champlain. Racket lake, a beautiful sheet of water in Hamilton county, embracing a surface of probably 20 or 25 square miles, is situated near the geographical centre of it, and may be regarded as its summit, particularly of that portion which lies west of the Adirondack mountains. The area of this tract is little, if any, less than 10,000 square miles; embracing nearly the whole of Essex, Hamilton and Warren counties, the southern and western parts of Clinton, the southern half of Franklin, the southeastern angle of St. Lawrence and northern half of Herkimer counties. These estimates are founded partly upon my own observations, and partly upon information derived from other sources, and should therefore be regarded as vague approximations only to topographical accuracy.

The natural features of this tract are prominent, and in some respects singularly interesting. The eastern division, commencing within a few miles of Lake Champlain, form the base of the Adirondack mountains. This mountain chain rises from the valley of the St. Lawrence, and takes a southern direction through Clinton, Franklin, Essex and Warren counties. It is then interrupted by the valley of the Mohawk, where it loses its name, although it shortly resumes a portion of its grandeur in the Catskill mountains.

In the county of Essex the chain attains its greatest elevation in the form of an aggregation of summits rising from an elevated base of nearly 3,000 feet in height. These peaks usually affect a conical form, and exhibit some other indications of their having been subject to volcanic action at some remote geological epoch. After the able and interesting relation by Mr. Redfield of his visits to the sources of the Hudson, it would seem unnecessary for me to add that there are probably few places in North America where Nature is invested with more magnificence and solitude than on these mountain peaks. Among the many summits which attain the perpendicular elevation of nearly a mile, Mt. Marcy is probably the highest, being 5,337 feet above tide. The western limit of this Alpine district is formed by Mt. Clinch,* about 8 or 10 miles south of Long lake, which apparently reaches the height of 4,000 feet; St. Anthony, (corrupted into Santanoni) a ridge of probably 5,000 feet high, between Long lake and McIntyre; and Mt. Se ward, perhaps 4,000 feet in height, a few miles north and in the line of Long lake, partially interposed between the Racket and Saranac rivers. The western division of this elevated tract presents a surface diversified with plains and hills, with little of it, which came under my notice, deserving the appellation of mountainous.

A striking feature observable throughout the whole extent of this high country, and one particularly interesting in an economical point of view, is the number and magnitude of its ponds and rivers, and the almost unparalleled extent of natural batteaux navigation that they form. It is also a remarkable fact that these waters, although belonging in some cases to different and remote systems, are situated for more than 100 miles in extent in nearly the same horizontal plain. This will appear sufficiently evident from the following table, in which the distances and directions are rudely estimated from Racket lake.

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* In honor of the Hon. Mr. Clinch of New-York, who was one of the original projectors of the survey now in progress.

				Elevation.
Racket lake,				1731 feet.
Forked do	8	miles	north,	1704 "
Long do	20	"	northwesterly,	1576 "
Upper Saranac lake,	58	"	"	1567 "
Round do	54	"	"	1567 "
Lower Saranac do	64	"	"	1527 "
Tupper's do	60	"	north,	1500 "
Rich do	30	"	northwesterly,	1547 "
Newcomb do	40	"	"	1699 "
Lake Sanford,	50	"	"	1712 "
" Henderson,	52	"	"	1826 "
Clear pond,	80	"	westerly,	1870 "

These distances are vaguely estimated by the courses of the rivers, or the most direct land routes, without seeking any greater degree of accuracy than is requisite for forming a *general* idea of extent. The elevations of all were taken by the barometer, except that of Tupper's lake, which is connected with my station below Racket-Falls by an unobstructed navigation, as I am informed, and consequently not very different from 30 or 40 feet below it.

These lakes are chiefly situated on the northeast quarter of this table, and that, too, which presents the most varied and mountainous surface. Judging from some examinations of my own, and from other sources worthy of confidence, the southern and western divisions are each equal in extent to this, and conform still more nearly to a horizontal plane which rests upon the surface of Racket lake.

Some general idea of the extent of natural batteaux navigation, may be derived from a glance at the Saranac and Racket rivers. The former of these rises near the southern line of Franklin county, in a beautiful expanse of water, of some 10 or 12 miles in extent, with a coast not less than 40. A strait, of about 30 feet descent, connects this with Round lake, which is three miles in diameter. The waters are then discharged through a strait of 3 miles in length and about 7 feet fall, into lower Saranac lake, which is 7 miles long and 3 or 4 broad. The distance, reckoned from the Indian carrying place, to the mouth of Lower lake, is about 16 miles, and the descent 40 feet, embracing only two portages, one of 80 and the other 20 rods in length. Continuing 20 miles northeasterly down the river, to Forbs', we encounter but three interruptions to the navigation, embracing an aggregate of portage of less than three miles, and a descent probably not to exceed 60 or 80 feet. The Saranac river, therefore, from Forbs', a point seven or eight miles north east of Whiteface mountain, near the north line of Essex county, to the head of upper Saranac lake, a distance of about 40 miles, furnishes a line of batteaux navigation, interrupted by an aggregate of portage of less than three miles and a half, and an elevation to be surmounted by locks or planes, not much exceeding 100 feet. The extent of country immediately benefited by this line, including the coasts of the lakes, and some lateral branches, can fall little short of 90 miles.

The Racket river, after communicating with Ragged lake, on the east of Racket lake, and with Forked lake on the north, pursues a northeasterly course through Long lake, and thence northwesterly to Tupper's lake. This embraces a distance of 70 or 80 miles, and a difference of level of 231 feet, of which probably not more than 175 would be found necessary to be surmounted by artificial contrivances. Four portages, equal in extent to about two miles, are the only existing impediments to a continuous passage for boats. The extent of country immediately benefited by this line, taking into account the coasts of the larger lakes, is probably not less than 200 miles. A chain of ponds likewise extends, as I am informed, and some of which I observed from the summit of Owlshead, from near the head of Long lake, in a northerly direction, to Tupper's lake.

The close approximation of upper Saranac lake to the navigable waters of the Racket, suggests a ready means of connecting these two systems of waters. The distance between them is only one mile, the land but little elevated above the surface of the former and the difference of level only between 20 and 30 feet.

Thus it appears, that by excavations equal in the aggregate to 6½ miles, and an amount of 240 feet lockage, continuous lines of navigation through, and connecting these two rivers, may be formed, equal in extent to 210 miles; and that this would be increased, probably, to more than 300, if we take into consideration the coasts of the lakes.

Respectfully yours,
FARRAND N. BENEDICT.

ACCUMULATION OF THE MATERIALS COMPOSING THE POTSDAM SANDSTONE.

This rock is thickest at the north, and becomes thinner, though not in regular gradation, as it extends southward. It therefore loses its importance in the latter direction. At Little-Falls it does not appear, but the succeeding rock, the calciferous sand-rock, rests immediately upon the gneiss. It may be inferred, therefore, that although there was an open sea, and materials were drifting in, yet, in consequence of the hardness and coarseness of the particles and masses, they were not in a condition to be transported far from the parent rock, but were deposited in shore or into an estuary, into which large rivers emptied their contents. It is a reasonable hypothesis, however, that those rivers which bore along the siliceous gravel composing this sandstone, might also transport calcareous and argillaceous matter at the same time. Those materials being soft, and partially soluble and miscible in water, would be transported far out to sea; they would subside but slowly, and moreover the rock composed from them would be partly mechanical and partly chemical. It is evident that the finer the particles, the farther they would be transported. In the breaking up of siliceous rocks, though much would be hard and in masses, still, in the attrition to which those masses would be subjected, much would become fine and impalpable, and might be carried along with the calcareous matter.

Such being the condition of things, we may consider the following as the natural results:

All the coarse, heavy masses would be deposited as soon as the current ceased to act upon them. These would constitute the largest body of the abraded materials, and form the thickest portion of the rock.—They would be in the line of their origin, and would indicate the course of the current or river which transported them. The finer, siliceous matter would be borne along farther, but would be deposited early; it would constitute regular sandstone. Another portion would be carried still farther, and would probably be associated with calcareous particles. These would subside also, and would constitute a siliceo-calcareous rock. All this is in accordance with what is found in the lower rocks of St. Lawrence and the other northern counties.

Near the provincial line there is a large mass of conglomerate, similar to the millstone grit. It is 300 feet thick, and is composed entirely of coarse gravel and small stones. A little farther south, it becomes a moderately coarse sandstone ; still farther the rock is a mixture of fine siliceous and calcareous particles, constituting the calciferous sand rock of Prof. Eaton.

From this we may learn that two rocks may be contemporaneous, for the deposition of the calciferous sand rock may go on simultaneously with the Potsdam sandstone. But they will differ in two respects: the sandstone will be found near the shore, and of course in shallow water, which will be indicated by ripple marks, and it will bear, or contain those organic relics which are peculiar to such locations. On the other hand, the calciferous will be formed in deep water, and will contain the remains, generally, of those animals which inhabit deep water.

It is evident that the lines separating two rocks found under such circumstances, would be faintly drawn. Nature has associated them together, and has only made a gradual transition from one to the other. We can find no abrupt discontinuance or commencement of either.—We may find gradual transitions, as in the example cited, extend to three or four rocks, and in the geographical range of the 2d district we accordingly find that it actually extends up to the Trenton limestone and the black slates above. In the several members constituting this natural association or group, there are characters in common, but a gradual departure appears, as we trace these masses upwards.

From these remarks we may see what ought to constitute a group of rocks, for it is evident that a group should consist of those members, and those only, which were formed under the same conditions, as it regards atmospheric agency. When this agency is uniform, there will be a uniformity in the organic productions. The great differences will be produced by shoal and deep water, but the productions of one will pass gradually to the other. Differences will exist in the extremes, but accident will more or less assimilate them to each other. When, however, atmospheric agency changes, when temperature is diminished a certain amount, then organic laws suffer an infraction and beings fall victims to the change. A few, however, are capable of surviving or resisting this change, and may continue while the mass is extirpated. Very few, if any species of animals of the Trenton limestone, have survived the atmospheric changes which occurred between that period and the carboniferous limestone.

Natural associations or groups of rocks cannot be determined by mineralogical composition or character, for observation proves that nature associates sandstone, limestone and slates, and it results mostly from the fineness, coarseness and miscibility of particles, or their capability of transportation. In the primitive construction of the globe, and in the elements constituting the primary masses, we find the siliceous, calcareous and aluminous earths. There is, therefore, nothing remarkable in this association. If these views are correct, we may avail ourselves of the principles contained in them in determining or constituting groups, and the order in which the members are to be placed. Slates, accordingly, usually form the superior bed, and the sandstones the inferior, though it may be questioned whether unexceptionable rules can be established. In the sandstones, the inferior portion is composed of much larger particles than the upper. In fact it is often a coarse breccia.— From this fact it follows, that the cause or causes producing the fracture of rocks, and also that which transports them, is more violent at the commencement than at subsequent periods, while, at the termination of a group, the particles are extremely fine, as in the calcareous and siliceous slates.

The Period when, and Causes by which the Northern Rocks were abraded.

In former reports I have had occasion to speak of abrasions which the northern rocks have suffered in ancient times. Those who have examined this subject, know full well that it is difficult, if not impossible to fix the precise period when the causes producing those effects were in action. That they were comparatively modern, may in some instances be shown to be probable by existing records of facts. Though I am of the opinion that abrasions will be found to have been produced in different periods; for when I examined the Trenton limestone on Lake Champlain, I found a layer of that rock, situated about midway in the ledge, whose upper surface was grooved and scratched in the usual manner, but which passed beneath the upper layers, and from above which, layers had been removed by quarrying, showing conclusively that this surface had been abraded previous to the desposition of the upper portion of this rock, and that this upper portion was deposited upon an abraded surface. If I was not deceived in the examination of this locality, then there is one instance which can in no sense be called modern. Still the instances which generally fall under our observation, appear much nearer our own times than the one specified, for the common abrasions which appear on the rock along the valley of Champlain, whatever that rock may be, is beneath the tertiary, which is a thin deposit of clay and sand. If then, those grooves and scratches were made just anterior to the deposit of the tertiary, then they were made in comparatively recent times, for the organic relics of this formation belong to those genera and species which now inhabit our seas.

Without consuming farther time and space in the consideration of the period when those abrasions were made, I will proceed to the consideration of the causes by which they were produced, or the theories which have been advanced to explain them.

One of the most prominent theories which has been advanced to account for abrasions, grooves, scratches, &c. is that which assigns the waters of the Noachain Deluge as the cause. This deluge, it is maintained, swept over the land with immense force, broke up the foundations of the rock, bore their fragments along with impetuosity, deeply scratched and ground those surfaces of the solid strata over which they passed. In this theory there is much plausibility, and something that commends itself to our assent. Still it is found, when tested, to be quite objectionable. One objection only need be adduced, viz: that the Noachain Deluge is much too recent an event to apply to the case in question; for as has already been remarked, the abraded surfaces are beneath the tertiary of Champlain, which though a thin deposit in the valley specified, still must have required too long a period for deposition, to have been formed since that catastrophe.

Another which has been offered, and is still supported and maintained by Geologists, is the *iceberg* theory. Icebergs or icefloes are known to be driven out to sea, and to bear along rocks and stones, which, as the ice melts, are dropped into the sea, and thus they become the instruments of spreading widely the fragments of the solid strata. Icebergs, it is supposed then, as they are borne by currents or driven by the winds, perform the office of wearing away the rocks, by means of their attached boulders, while they are firmly frozen in, or imbedded in their inferior portions. This is a favorite theory with geologists, and it is certainly one which explains admirably the transportation of boulders, and their dissemination over wide areas at the present day; but is it adequate to the explanation of what are termed diluvial grooves and scratches, and moreover the polishing of rocks, which in the case of limestones, is often quite perfect? It is thought not, for the following reasons: 1st. The immense width of country over which those polished surfaces are found almost continuously. 2d. There is a nicer uniformity of action exhibited on those surfaces than apparently could be produced by icefloes. But in the 3d place, those polished surfaces were made before icefloes were known in the earth's history. That the movement of mountains of ice in the sea is a modern event, is clear, when it is known that no large boulders occur in any of the rocks. It is evident they ought to be found, in case they existed during the deposition of the earlier strata, for then as now, they must have been loaded with rocks and stones, and then as now, they would have been dropped and scattered over the bottom of seas where rocks were forming, and which would have inclosed them, and which, ere this time, would have been disclosed by human agency. The large boulders which we suppose may have been transported by ice, overlie all other formations, and I have not been able to find even in the tertiary class of this State a single rock. Occasionally I have met with very small stones, such as are transported by moderate currents of water. If ice, carrying stones and rocks, wore and polished the rocks in the great valley of the St. Lawrence, we ought to find stones and rocks in the deposit immediately upon those surfaces, but as we do not find them, we are compelled to assign some other reason for this abrasion than ice in the transportation of boulders.

The whole appearance of the polished surfaces is such, as to indicate at least great uniformity of action, an appearance more in conformity to what we should expect to result, from running water bearing along sand and gravel, alternating with currents of great power, during which increase, larger stones were forced along. In connexion with this subject, I may very properly mention the existence of an immense *pot hole* in a ledge of granite in the town of Antwerp, and in the open country. It is at least 100 feet above the Oswegatchie, three-fourths of a mile distant, with an intervening hill, higher by some 50 feet than this remarkable hole. This ledge of rocks skirts a valley on the west which is about 100 rods wide, and its direction is about north and south. This hole is from 24 to 30 feet deep, and from 12 to 14 feet in diameter, bearing the usual marks on the interior of water-worn surfaces. Upon the summit of the intervening high ground and the river, we find the polished rocks ; in one place a mass of the Potsdam sandstone, still adhering to the primary, 7 or 8 feet in diameter, of an oval form, and about 2 feet thick, is all that remains of the stratum at this place, and grooved in the usual manner, with the scratches in a north and south direction. Now, is there any connexion between the pot hole and the abrasions of the sandstone? We know the former could not have been produced by an iceberg, and probably not by the deluge, but we know they are the effects of running water. There may be a connexion, but it is not possible to demonstrate it. Both phenomena have the appearance of having been produced by one agent, but we are wanting in facts, and are necessarily obliged to wait the progress of discovery either to prove or disprove the inquiry.

It is evident, objections to theories are easily raised, and it is difficult even to propose one to account for ancient phenomena, which shall be free from objections. This is strongly felt by all who have attempted the task. In relation to the phenomena which have been discussed in this chapter, it is clear that we are not yet in the possession of facts which can sustain any theory. It is not sufficient that we admit that the *deluge* may have carried along stones, rocks, &c. or that *ice-floes* do the same, since both may be shown to belong to periods more recent than the phenomena they are intended to explain.

FIVE HINTS TO AGRICULTURISTS.

1*st*. *Drainage*. The cure of a very common evil, that of a cold, wet soil, may be effected by knowing the nature of the rock which constitutes the substratum. Springs which supply this excess of moisture, issue from reservoirs formed in the cavities of rocks, and it is a very common circumstance, that the issue of water is at the edge of the jointed rock, or perhaps the efflux of water is determined by a fault.—In either case, the remedy is to drain the water into the joints of the rock. It may be, however, that drainage cannot be effected. The nature of the substratum or rock determines the question. Geological knowledge is required in the first place, to know how, and in the second, to determine when it is possible to effect it.

2*d*. *Wells, and boring for water.* The place for boring for water may be determined by the direction of a *fault.* Springs may generally be found at a fault, whether that is in a solid rock or in a clay bed, for the layers of many stratified rocks, and of clay, being impervious, the water will flow along the layers till it finds some obstruction; that obstruction will be in the line of a fault, when it may be brought to the surface by piercing to the layers on this line.

3*d*. *Valuable materials below the surface.* Substantial products for enriching the soil often exist a few feet only from the surface. It may be *peat*, or *marl* or *marly clay*. A little geological knowledge is useful for the determination of the question.

4*th*. *Building materials. Durability* is the main question to be determined. The layers of any given rock are not equally durable. Rocks, or those portions which are pulverulent, or are acted upon by atmospheric agents, though they are worked easily, are to be rejected, while those layers which project and have withstood the elements, may be selected.

5*th*. *Knowledge of soil, substrata and water.* This knowledge may be valuable, not only as it regards crops, but cattle; for, as in the vegetable kingdom some species prefer a certain soil, so in the animal there are some species which express a similar choice, and manifest the reresult by health, thrift and a good condition. Goodness of soil does not wholly depend on chemical composition and a certain mechanical mixture, but is influenced by substrata, mostly in consequence of their conductibility of heat, and their power of absorbing water. Hence the questions of a change of crop, or change in the range for cattle, often rests on geological data.

E. EMMONS, M. D. *State Geologist.*

Albany, *Jan*. 1. 1840.

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FOURTH ANNUAL REPORT

Of the Geological Survey of the Third District, by Lardner Vanuxem.

This report, in accordance with the plan of the survey, must form the last of the annual ones, the four years allotted to the survey ending on the first day of July next; and on the completion of the final report of the district, which will be the next in order, our engagement with the State will be at an end. It is evident, from the number of rocks and groups of rocks in this district, that there was much to do, and the time given to perform the work comparatively limited; much detail, therefore, will for the present remain unknown, though much will be known; yet it is better to bring the survey to a close at the time specified, even though not perfected, than to prolong it to another period. What remains unfinished, can be finished by the person or curator who may have charge of the State collection.

That a vast mass of facts will have been collected and presented to the public, there can be no doubt; the whole of the rocks, their characters, both mineral and fossil, likewise their mineral associates, will be known; their order of succession, also, and their geographical distribution. Much light will be thrown upon an early period, and one of long duration in the world's eventful history, and important light, too, which must be known, if we wish to acquire knowledge of the ways of its Creator, exemplified as they are in his marvellous works.

Our former reports embraced the counties of Montgomery, Fulton, Herkimer, Oneida, Oswego, Madison, Onondaga, Cayuga, and some parts of the more southern counties of the district. To complete the report of the northern counties, there yet remains Lewis and Otsego; the former county we shall report in brief, and leave the latter one for the final report, not having sufficiently examined its northern edge and its eastern limits. The latter forming, as they do, a part of the boundary between the first and third geological districts, we have proposed with

Mr. Mather to examine in the spring the whole of our common line, being desirous of obtaining an accordance of results, which could not be so well effected as by a conjoined examination.

The subject matter of our report will consist of Lewis county, and an abstract or summary of all the rocks and groups of the district, preparatory to our next communication, which will be the *final report of the district.*

It must not be supposed that we have given in this and in our former reports, all the useful matter collected, for this reason, that the term useful is too relative, and our reports, at least my own, have been made and given merely as reports of progress.

LEWIS COUNTY.

This is the only one of the northern counties of the third district not noticed in the former reports, its examination having been left to a late period of the survey, wishing to avail myself of whatever progress might have been made in the excavation of the Black River canal, and the quarrying of stone and other materials for the same.

The Black river divides Lewis county into nearly two equal geographical parts, draining the whole of its surface, with the exception of a small portion of the northeast and a similar portion of the southwest. No less important is this river in its hydrographical than in a statistical point of view, for it forms the boundary between the primary or the sparsely settled region to the east, and the transition of those rich limestone, slate and shale lands to the west, which in the early settlement of the county were well and far known under the name of *the Black River lands.*

The geology of Lewis county, though it has many distinct rocks, yet from their regular geographical distribution and undisturbed position is quite simple. Its rocks are the primary, the Potsdam sandstone, the fucoidal layers, the Mohawk limestone, the Trenton limestone, the black slate, the Frankfort slate, and the shales of Pulaski. All these rocks, with the exception of the Potsdam sandstone and the fucoidal layers, pursue a uniform north and south direction through the county. The whole of the primary lies to the east of Black river and along the margin of the river, excepting at its entrance from Oneida. The Potsdam sandstone is only met with in the northeast part of the county, near to Jefferson and St. Lawrence, resting upon the primary, the two being unconformable to each other; the primary showing in all places visible, the same disturbance in its parts, and the same water worn appearance, which elsewhere in western New-York is so characteristic of it; whilst the sandstone is more or less horizontal.

Quitting the primary and proceeding west, we find the land rises with considerable altitude towards the source of the tributaries of the Black river. These take their rise in the sandstone and shales of Pulaski, and descend to the river over the Frankfort and the Black slate, the Trenton and the Mohawk limestones; each of the latter rocks forming a narrow terrace for its great length, and, as might be supposed, the waters descending from one elevation to another, give rise to numerous cascades, some of great height and beauty.

The two sides of the Black river strongly contrast with each other, as to rocks, soil, vegetation and population. The surface of the east side, or primary division, consists, with few exceptions, of an almost unbroken range of forest, spread upon an uneven surface, the result of materials or masses first disturbed, and subsequently water worn; no part of its surface in Lewis county presenting elevations of consequence, excepting near the southern part, where it joins to Oneida: there it forms low mountain ridges. The western side of the river, on the contrary, is well settled, and exhibits those steps or terraces common to horizontal rocks or undisturbed mechanical deposits, presenting an almost unbroken outline, the lowest mass of which, the Mohawk limestone, rises and forms the west side of the river valley, either by the side or upon the primary, and presents a cliff or mural precipice, extending through the county.

In no part of the whole of the division east of Black river, could I find or hear of any rock but which formed a part of its mass, with the exception of the fucoidal layers and the Potsdam sandstone; and these were partial, confined to narrow limits, and north of a line passing from the natural bridge to Harrisville. Thus it is obvious, that the county is naturally divided into two geological divisions, the eastern formed of primary masses, and the western those of the transition class.

With this brief outline of the geology of Lewis county, we proceed to such observations as relate more particularly to an economical report.

From all that I had time or opportunity to observe, the primary mass presents but few rocks, consisting chiefly of granite and that peculiar kind of gneiss common to the west primary region of New-York. This kind of gneiss contains but little mica, and shows little tendency to decomposition, disintegration or alteration, and is therefore well fitted to be a good building stone, as regards durability. The same remarks also apply to granite, its associate. In the third district, these two rocks are of contemporaneous origin.

The only common metallic mineral which is common in Lewis county to the two rocks, is magnetic or rock iron ore; this in some places is so much intermixed with the rock as to appear like a constituent; but I did not meet with any locality where it was in sufficient abundance to be worked; yet it is a fair inference, that where it is found disseminated in a rock, it is probable that it may exist in larger particles, or workable masses. This ore was noticed near Lewisburgh furnace, at the High falls also of Black river, at Lyonsdale, and on the road from Harrisville to the natural bridge.

The rock ore may readily be known by its being highly attractive of the magnet, by being black in the mass, and black in its powder. It forms the iron sand so often met with in the streams and sands of the primary region, having been set free by the destruction of its parent rock, and subsequently accumulated by the action of water.

Magnetic iron ore forms the colouring matter, and contaminates, likewise, some of the minerals of the primary rock. The alteration which it has undergone in some places, is highly instructive, and corroborative of facts, brought forth in the second report, of an action of thermal waters at the junction of the primary mass, and its unconformable overlying masses.

At Little-Falls, the primary rock presents numerous cracks or fissures. In some of them the rock, which is usually some shade of gray, is observed to be of a bright red for many inches from their surface, and sometimes the sides of the fissures are coated by the same red mineral, apparently an exudation. This colour is caused by the iron of the rock, altered by the action of hot or thermal water, for when the alteration of the black oxide of iron is unaccompanied by heat, the tendency is to the forming of an hydrate, which produces either a yellow or brown colour, according to cohesion. That this action has operated to a great extent in some other parts of New-York, is evident from information communicated by Prof. Emmons; for masses which evidently, from the structure of their particles, were once magnetic ore, have lost the property of attracting the needle, and have been changed to those of a higher degree of oxidation.

Whilst on the subject of magnetic iron, it may here be well to mention the new locality of this ore, discovered last year, about two miles to the north and east of Salisbury-Centre, in Herkimer county, on the land of Congdon and Gifford. The ore appears near the surface, on a low hill side, composed of various kinds of gneiss with hornblende rock. The course of the layers of the gneiss is nearly east and west, highly inclined, with a south dip. The ore appears as a bed, being parallel with the gneiss and hornblende rock, the whole intermixing with each other, so as to show a contemporaneous origin. Where the bed has been opened, it is quite irregular as to width, varying from a few inches to nearly two feet in thickness. There seems to be something like a curving or rolling of the ore and its associates, resembling the contortions frequently seen in gneiss and other crystalline laminar rock. From this cause it was difficult, at the time of my visit, from the smallness of the excavation, to form any correct opinion of the quantity of ore, or in other words, value of the deposit. Since being there, I have been informed that from one to two hundred tons of ore have been already obtained from the deposit.

By means of the compass, the ore has been traced for a mile or more to the east, and in the direction of its line of bearing where opened. There, when about twenty feet from the excavation, and on its north side, at a right angle to the line of bearing, the needle begins to show signs of being acted upon; and in advancing towards the opening, or mass of ore, the action increases and finally the position is reversed, the needle finding its north at the mass.

The same action, in all respects, upon the magnetic needle, is observed from place to place, for the distance mentioned, showing that, as a mass, it is not continuous, though it has a given direction or place, analagous, in this respect, to all subordinate masses, uniform as to position, but without continuity. That this is no generalization from one fact, is evident from observations on the adjoining tract, owned by Prof. McVickar. There, at the bottom of a brook whose waters cross the layers, and have uncovered the rocks, we find the same ore, with the same associates, and there the action of the needle was the same as in the first instance mentioned.

Besides the magnetic ore, there occurs, in Lewis county, two other ores of oxide of iron, both of which are intermediate in age to the primary rocks which contain the magnetic ore and the Potsdam sandstone. These ores are the specular or oligiste iron and the red oxide, a variety of the hematite.

So far as the third district has been examined, these ores have only been met with in the northeast part of Lewis county, and as yet but in small quantity. It would appear that their geographical range, in the third district, corresponds with their range in the second district, both being confined to the north and eastern slope of the primary region.

The specular or oligiste is the next kind as to age. It differs from the magnetic by its powder being red, though it is black in the mass. It does not occur in the granite and gneiss, but with highly crystalline limestone. In all places where I met with this ore in the county, it is in masses, either without any determinate form, or more or less wedged shaped, and invariably limited as to quantity. When first discovered, there seems to be the promise of great abundance, so large are the masses, which are free from all other mineral or extraneous matter; but soon a locality is exhausted, disappointing the high expectations entertained of its richness. This is the same kind of ore which has given so much celebrity to the island of Elba, and to Framont in France, from the great beauty of their specimens. This ore contains more oxygen than the magnetic, and less oxygen than the next or third kind, the *compact red ore, or the hematite.*

The third kind is a variety of the hematite, being compact and not fibrous in its structure. It is red in the mass and red in its powder.—It is more or less mixed with the specular ore, and from having numerous cracks or separations, it is usually coated with fine scales of the red iron froth of the Germans. In every place where I saw the red ore, it was connected with siliceous and with steatitic matter, rarely with carbonate of lime, unless associated at its lowest part with specular ore.

It is but recently that the red ore has been discovered in Lewis county, and though it cannot have an extensive range as to location, yet near to Lewisburg furnace there is the appearance of abundance. At the place in question, the thin mass of quartz conglomerate, which forms the bottom part of the low ridge of Potsdam sandstone, shows that the scaly ore or froth has exuded by its seams and cracks; and where excavations have been made, at the foot of the ridge, in the loose materials which there exist, and near to the seams and cracks, the froth is observed in unusual quantity, accompanied by the solid red and specular ores. At one place at the foot of the ridge, where there was a promise of ore, on excavating a few feet, the crystalline limestone, with specular ore, was found in connection with steatitic matter, showing, to appearance, a common age for the ores.

This locality, which is about two miles from the furnace, is one of the best I have seen for observing the position which the specular and red iron ores hold in the geological series. The hard red ore with the red froth is there connected at their upper part with sandstone which makes a part of the conglomerate, above which is the Potsdam sandstone. These rocks at their junction with the ore are inclined; but at a short distance the conglomerate disappears below the soil and the sandstone presents its usual horizontal position. Below the red ores are the specular ore and its calcareous associates; and these at another excavation made for specular ore, are seen reposing upon primary rock.

The Potsdam sandstone becomes, therefore, a good guide for the discovery of the specular and red ores. Knowing that their place or position is above the primary and below this sandstone, we are certain that where the sandstone exists, that whatever ore was deposited below it, there it exists; but when this rock is absent, so great has been the action of destructive agents through the primary region, that we have no guide for its discovery, excepting its actual presence.

The red iron froth or scaly iron ore so soft and greasy to the touch, is readily imitated by calcining equal portions of common salt and copperas. After that operation the soluble part is to be removed by washing with water. It is then used for razor straps.

Carburet of iron. Not far from the natural bridge on the land of Mr. Cleaveland, there is an extensive deposit of this mineral or plumbago in extremely fine particles mixed with what appears to be chlorite, and also some epidote and probably idocrase. The plumbago in consequence of its mixture with other minerals is of little or no use to which this substance is usually applied, but from its apparent great abundance ti might be used as an iron ore and with care may be converted by one operation to steel and of the best quality; for a like combination must produce a first rate metal as to quality, which experiment in the ordinary way on a small scale, has shown, that the iron obtained from it was of the best kind.

This is the mineral which has made some noise as a silver ore, which it was calculated to do from its unusual appearance and its great quantity. Many satisfactory experiments are cited in proof of its containing silver, all which experiments are negatived not only by the non-existence in nature of any ore of silver of the kind, but by the fact, that silver will not unite to carbon, nor will it unite with iron in greater amount than one five hundredths. In combining silver with steel for the purpose of increasing its hardness for razors and other instruments requiring a keen edge, it has been found that when more than the quantity just named is fused with that metal, the silver exhibits itself throughout the mass in the form of filaments or threads ; now no such appearance was visible in the experiment made to ascertain the quality of the iron which the ore would produce.

The chemical department of the survey belonging to Dr. Beck, an analysis of the ore no doubt will be given by him and which will be decisive of its nature.

The plumbago ore is connected with steatitic masses, some green, white, black, &c. Likewise with dark greenish masses, containing pyrites, the kind connected with the base of the specular ore. I also noticed a peculiar porous rock, with fine scales of plumbago, which I met with in another locality near Sommerville, between Parish's and Kearney's ore beds.

The plumbago ore shows itself on Mr. Cleaveland's land in several places on the side of a hill, back of which at no great distance are the usual gneiss and granite masses, and I should judge that the whole of the product noticed, were an overlying deposit to these rocks, and analogous as to cause, origin and position, to the second and third deposits of iron already mentioned.

As natural bridges are not of frequent occurrence, a word in passing seems to be necessary. The bridge exists at the bend of a branch of Indian river near to the village of its name. It is formed merely by a cavity or fissure in the primary limestone which there abounds as an associate of the usual granite gneiss rocks. A portion of the water passes by the cavity, whilst other portions pass round the bend and under the wooden bridge beyond, Near to the bridge Mr. Williard has excavated for copper as I understand, but I saw no other metallic mineral there, but some beautifully tarnished pyrites.

Since the discovery of the Rossie lead vein, innumerable excavations have been made for ore; and profitless in many instances have been the expenditure of time and money in its pursuit. In one place we visited a large excavation in limestone made for lead ore, the rock showing none; but it contained plumbago in scales. The cause of the excavation was owing to the common name of this mineral, *black lead*, misleading its pursuers, they supposing that from similarity of name, there was a connection of composition and origin. They were not aware that the composition of black lead was carbon and iron, and that not one particle of lead entered into its composition, or was it in any wise connected with lead, else their time and money would have been saved.

Potsdam sandstone.

This rock appears in the northeast part of Lewis county, in low ridges, and with all the characters given by Prof. Emmons, in whose district it is an extensive rock. It is well suited for building, and for the the lining and the hearth stones of furnaces.

Fucoidal layers. These are the layers which are interposed between the "calciferous sandrock" and the Mohawk limestone, and which are so abundant in the valley of the Mohawk. They appear to be almost horizontal to the eye, and may be seen on the road from Lewisburg furnace to the natural bridge, extending thence north and east into the second district.

With these notices and remarks, we terminate for this report all that we have to say of the primary rocks and their overlaying masses of the region to the east of the Black river, and proceed to those masses which follow them in age, and which extend west from the river. The first of these is the Mohawk limestone, no other rock being visible between it and the primary, along the whole line of its course in the county.

Mohawk limestone. This rock in our former reports was connected with the "bird's eye," but in extending our researches from county to county, we found that a separation seemed necessary, and we adopted the division set forth in Mr. Conrad's last report, correcting the error which had crept into it, of placing this limestone upon the "bird's eye," in lieu of making the latter the upper or superior mass.

The Mohawk limestone is an extensive and thick deposit, in Lewis county, making its appearance near Boonville, on the river, and extending without interruption through the county, with a thickness which cannot be less than forty feet.

Near to Boonville its upper layers are even with the level of the river, but the rock rises from thence, attaining its greatest elevation a few miles below the village, exhibiting a cliff or mural edge, whilst traversing the county, its layers falling with the river from the point of greatest elevation, and from thence dipping probably to the northwest.

In no place could I see this limestone reposing upon the primary, or observe what rock was under it, from the lower layers being concealed by soil or other extraneous materials. No rock can be seen between it and the primary, which we before have said forms the margin and bed of the river.

The Mohawk limestone is extensively quarried near Boonville, for the locks of the canal. Its layers are thick, solid, with joints in two directions perpendicular to the layers, is easily worked, undergoes no change but solution, and for building purposes only inferior to the Onondaga limestone, not having the toughness of the latter.

About half way in the series, there is an earthy drab or yellowish coloured limestone, which is burnt and used at Lowville for water lime. That it contains silex and perhaps alumine, seems certain, for when too much heated, its surface, I was told, fuses into a glass. Dr. Emmons has since informed me that sulphate of strontian has been found in it, which I did not see.

The Mohawk limestone does not afford any metallic mineral, its value consists in furnishing good lime by burning, and a first rate material for building purposes.

The "birds-eye" limestone does not occur in Lewis county, and by its absence causes the Trenton limestone to rest immediately upon the Mohawk limestone, and to form the second terrace west of the river.

Trenton limestone. This rock underlies the villages of Lowville, Martinsburg, Denmark and Copenhagen. It seems to increase in thickness from Boonville to Copenhagen. At the latter place it must be 300 feet thick, showing a great increase in its progress from the

Mohawk river, where in no place is it 30 feet in thickness. Its layers, like most of the New-York rocks, are generally divided by cracks or fissures, having a two-fold direction, presenting a double system of parallel lines of separation. Though the cracks are not always continuous, owing to unequal resistance in the rock, yet their direction nevertheless is uniform, and to speak approximately, for the sake of a convenient expression, their direction is north and south for one system, and east and west for the other system.

High expectations were at one time entertained, that this rock would prove to be a metalliferous one from the abundance of small particles of lead ore, visible near Martinsburg, about half a mile northwest of the village. The working for ore was commenced at the upper part of the limestone, which there has but a thin covering of earth or soil. The rock shows the two-fold system of cracks or joints, more or less regular as to direction and irregular as to width. These cracks or joints, are filled with white sparry limestone, containing ores of lead, zinc and pyrites, forming as many veins in the space uncovered, as there are east and west joints or cracks. The veins are not always continuous, either downwards or in a horizontal direction, from the cause before mentioned, so that they are often interrupted, and a rock without seam or any indication of one must be passed to recover the part lost. In width, the veins vary from walls almost in contact with each other, to walls eight or more inches distant from each other. Sometimes the vein divides in consequence of two cracks or joints coming together, or conversely, two joints meeting in one.

There are several parallel workings, all " open to the day," one of which extends for 200 feet along the surface, and in one place is 50 feet deep. The ore is galena, accompanied by blende, and copper, and iron pyrites, having a matrix of white laminar and granular carbonate of lime. There is an appearance of calamine in some of the ore, in which the galena presents a beautiful feathery form of crystallization.

The workings are now suspended. About $3,000 have been expended upon them, and the quantity of metallic lead obtained was but small for the ore obtained, and for the money expended, owing, as I am informed, to the quantity of rock excavated for the ore gotten out, and for want of a proper system of drainage, &c. That there is lead ore in that locality is certain, from the numerous cracks or veins which show its existence, but unless larger veins should be discovered, the profit must, from past experience, be hopeless. No further attempt should I think be made to resume this working, before parallel north and south trenches are opened in order to ascertain the widest and most promising of them.

In the same limestone rock, near the head of the small falls, in the creek at Lowville, there are small excavations on the left side of the stream, from which ore supposed to contain silver, existing in narrow veins, was extracted. The ore proved to be galena, blende and copper and iron pyrites, having for matrix carbonate and fluate of lime. Both these localities were noticed mineralogically by Dr. Beck.

The ore occurs in the same system of cracks or joints as at Martins burg, and clearly shows an infiltration or exudation from the rock, both galena and blende having been found at the latter place enveloped by the solid rock, so as to leave no doubt, that the rock was the source from whence the veins derived their material. The occurrence in these two places of metallic minerals, in an east and west direction, a fact so general in all countries, is of importance to the true theory of veins, and show a connection with the galvanic one, either as cause or effect, and wholly adverse to the theory which makes them the result of injection from below, for in that case there would be no difference as to quantity of ore, in the different systems of veins or fissures.

Besides these facts, there are others in the third district which show that injection could not have been the operating cause. Of the five localities where ore exists in veins, two of them are in the upper part of the Trenton limestone, and two in the lower part of the black slate which rests upon that limestone. These facts show a connection between the veins and the rock, and moreover, they are cut off from the source of injection, if the primary rocks be that source, by the Mohawk limestone, the fucoidal layers and the calciferous sandrock, none of these rocks in the third district showing ore in veins or in like abundance.

The fifth fact is the instance cited in the second report, of a small vein of lead ore, existing at the junction of the black slate and Trenton limestone with the "calciferous sandrock" and "bird's eye" limestone, at the up-lift on East Canada creek, and there the ore is on the side of the two former, and not the latter rocks.

Upper rocks of Lewis county. In proceeding west after leaving the terrace or level of the Trenton limestone, we ascend the black slate, then its successor the Frankfort slate, and finally the Pulaski shales. On these latter the waters divide, going east and west. Those of the west descend over rock, which though holding a higher geological level, yet are geographically lower, exhibiting the same phenomenon observed on the south side of the Mohawk valley, after attaining the height of the elevation, or the point from whence the waters divide, showing that the uplifting cause has operated upon the south and west side of the primary nucleus, in an uniform manner.

Having communicated all the information that we wish to give in this report of Lewis county, our next subject is a summary of all the rocks and groups of rocks which compose the third district, with such other matter or information which may seem necessary, since some of the counties of the third district have not been noticed in the reports that have been made. In this summary we shall commence with the lowest rock or mass, then the next in succession, terminating with the last one in the district.

Primary rocks. Granite and gneiss constitute the base or substratum of the third district, having occasionally for associates combinations of one or more of their mineral elements, with amphibole or hornblende forming sienite, granito-sienite and hornblende rock; likewise some aggregates of which granular carbonate of lime is the base, and other more rare in which we find pyroxene and table or tabular spar. It is with hornblende rock, granite and gneiss, that magnetic ore is usually associated.

All these rocks and aggregates are designated as primary ones, meaning thereby, that their origin was anterior to *all known organic bodies*, and that their mineral particles or their parts, are the result of crystallization.

The primary rocks form the northern part of Herkimer and Fulton counties, the northeastern part of Oneida, and the whole of Lewis county east of Black river, being the south and west part of that immense nucleus, which from a height, according to Prof. Emmons, of nearly 6,000 feet, descends with great irregularity, and disappears under the less ancient rocks which border the St. Lawrence, the Champlain, the Mohawk and the Black river, appearing again west in the Ozark mountains of Arkansas and the iron mountain of Missouri.

Besides the above localities of the primary, we find it as before stated, forming the base of the uplifts of the Noses, Little falls, and also Middleville.

Great contrast exists between the layers of the primary masses and those of the transition class contiguous to them. The former presenting disturbed appearance, exhibiting high grades of inclination, whilst those of the transition are like the deposits of tranquil waters, and to the eye often present an almost horizontal outline. From this difference many important inferences follow, one of which only at this time will be mentioned, namely, that the disturbance of the primary, was anterior to the deposition of the transition class of the third district, and shows the propriety of their separation.

We have said that the layers of the transition rarely present other than an horizontal appearance, but when examined they show a two fold dip or inclination, one general in accordance with the contour of the primary nucleus, the other conforming to its more local changes or features.

Specular and red ores of iron. These ores are to be referred to the period which intervened between the two classes of rock as they exist in the third district. That there are some members wanting to complete the series of that period is certain, from observations made out of the district, and in other counties which we shall advert to in our next report. To this period however we would state at present, that we should refer the Cambrian system of Prof. Sedgwick.

Potsdam sandstone. This rock is well characterized in the northeast part of Lewis county, agreeing in all respects with the same rock in the 2d district. South of that county it is not so, and therefore there are several varieties of it. Under this name, we include the layers below the " calciferous sandrock" at the Paper mill on Spruce creek, and likewise the layers below the same rock on East and West Canada creeks and at Amsterdam. In all these latter localities the structure of sandstone is lost, and therefore in all respects unfitted for the purposes to which the northern sandstone is applied, namely, the lining of furnaces and for their hearth stones. For a full account of this rock, see Prof. Emmons' report for 1838.

At Keeseville the Lingula ——— abounds in this rock. As yet I have seen no fossil in it.

"*Calciferous sandrock.*" This rock is abundant at all the uplifts on the Mohawk, and in many parts of the new county of Fulton, formerly the northern part of Montgomery. It is found to the east and south of Amsterdam, the Noses, St. Johnsville, Little Falls or Rockton, and on the East and West Canada creeks, and on Spruce creek, a tributary of the former. I did not meet with this rock north of Oneida county. At the Noses and Little Falls it rests immediately upon the primary, without any intermediate mass, but in other places, those layers which correspond with the Potsdam sandstone intervene.

The "calciferous sandrock," in many localities abounds with cavities large and small, often containing rock crystals and small quantities of anthracite coal. Frequently the large cavities, which in part are filled with crystals, have a covering of coal, which is flattened or depressed towards the centre, showing that the coal was in a soft or yielding state. In other cavities, the coal is sometimes found in the form of drops or buttons. These facts show that the coal was once bituminous, and had by heat been changed to anthracite. In some of the cavities the whole of the crystals, amounting to a peck or more, will have their angles and edges rounded from friction, either from water having entered with a circular motion, or that a motion of the kind had originated from either vapour or gas. That this rounding of the angles and edges of the crystals was anterior to the solidification of the coaly matter, is evident from the fact of the anthracite covering, in the manner above mentioned, the crystals which had been rounded by rubbing one against another.

At the Noses, Little Falls and Middleville, this rock attains its greatest thickness, being about 250 feet thick at Little Falls.

In the second district the Lingula acuminata characterises the calciferous, but I have not seen this fossil in the third district, nor any other than the casts mentioned in the second report.

Fucoidal layers. These layers were separated from the above rock from their distinctive characters, position, and finding them in Lewis and Jefferson counties, without the "calciferous sandrock" upon which they rest. It is in these layers that we first meet with that peculiar class of marine organization, in all probability vegetable, which for convenience have received the name of fucoides. In these layers, they are evident and abundant, though the forms more or less regular, arising from the mixed mineral nature of the layers, may be confounded with those of the fucoides. The fucoides are yet undetermined.

The best localities along the Mohawk for the examination of these layers are the falls on the creek near Spraker's basin, and by the side of the rail-road, opposite to Fort-Plain—greatest thickness about thirty feet.

Mohawk limestone. This is the rock so extensively quarried for the enlarged Erie canal at Amsterdam, Canajoharie, Fort-Plain and other places along the Mohawk river, also along the Black river, for the use of its canal. Its layers are thick, solid, easy to work from being somewhat brittle, but for hardness and solidity must form very durable mason work.

Its associates are the water lime of Lowville on the Black river. At Canajoharie some of its layers contain a greenish matter analgous to "green earth;" others are brownish and sandy, probably from union with the fucoidal layers below them.

It contains no metallic mineral, if we except a little iron pyrites, of which very few of the New-York rocks in any locality, are entirely destitute. Greatest thickness about 40 feet.

Its characteristic fossil is the orthostoma communis; there are several others, none of which have yet been described or named. In this rock we first meet the genus Cytherina. The individuals, however, are but few in number.

"*Bird's eye*" *limestone.* This rock is confined almost entirely to the Mohawk valley, and invariably where it exists, it rests upon the last mentioned limestone, forming the upper layers (from memory) of all the quarries to the west of Canajoharie, embracing those on East and West Canada creeks, with the exception of the quarry on the south side of the river west of Little Falls.

This rock is eminently characterized by the fucoides demissus which is often replaced by crystalline limestone, and sometimes by black and by green mineral matter, which exhibits the outlines of the fucoides in strongly marked characters. When the taste of our citizens shall incline them to simple colours, like the drab and dove, then the "bird's eye" and the Mohawk limestones will be resorted to for marbles, from the beautiful shades of these colours which they present.

Trenton limestone. This limestone is usually in thin layers, of a black, dark and a light grey colour. The layers are generally separated by black shale or slate, and to which the colour of the rock is owing. This limestone is abundant, and is found in the counties of Montgomery, Fulton, Herkimer, Oneida and Lewis. On the Mohawk its thickness rarely exceeds 30 feet, but increases through Oneida and Lewis, being 300 feet in the north part of the latter county.

Being the only rock at Trenton falls, it from thence derives its name. There are two divisions of this rock, the dark which is the lowest mass, and the grey which is the upper mass. This latter is less abundant and is principally found in the towns of Trenton, Floyd and Steuben of Oneida, and Newport of Herkimer. The Trenton limestone is loaded with the remains of animal life. In the preceding rocks there was but the dawn, but in this the full existence for the kind.

Of the Crustacea we have Isotelus gigas, I. Cyclops, Cryptolithus Tessellatus, Asaphus tuberculatus, Calymene blumenbachii, Ceraurus pleurexanthemus and Illanus perovalis ?

The Testacea are Strophomena deltoidea, S. alternata, S. semiovalis, Delthyris microptera, D. pecten, Orthis' glabella, O. testudinaria, Lingula ovata, Orbicula ————, Bellerophon apertus, Pleurotomaria cirriformis, Trocholites ammonius, Phragmolites compressus, Conularia quadrisulcata, Orthoceras duplex, O. striatum.

The Polyparia are Trianisites cliffordii, Columnaria sulcata, Cyathophyllum ceratites, Gorgonia.

Of Plants. Fucoides dentatus.

These are but a part of the many fossils which have been obtained from the Trenton limestone, but these are all that have as yet been identified and named. In this rock is the Lead mine of Martinsburg and the supposed silver mine of Lowville.

Black slate or shale. There is no mineralogical difference between the shale which separates the dark coloured layers of the Trenton limestone and this rock, but though in many localities it contains thin beds or flags of limestone in the lowest part of its mass, yet we often find above these thin beds, a thickness of two or more hundred feet, without any limestone whatever. A separation therefore was necessary.

Were it not that quarrying for limestone is carried on to the greatest extent upon the Mohawk, incidentally furnishing thin layers of limestone for flagging, and at a cheap rate, those of the black slate would be sought for, being thin, level and smooth. They may be obtained in almost all the water courses which flow over the lower part of the black slate in Herkimer county, on both sides of the Mohawk. We noticed some very excellent ones back of Little Falls, near Stephen Hammond's, not far from the old road to Fairfield. Near to these flags, in a small water course, at a higher level in the slate, there are two thin seams of sulphate of strontian, of a bluish colour and fibrous texture. In the thickest seam, which is about the third of an inch, that mineral shows in some parts a mixture with carbonate of lime in all proportions. There is also near to the strontian, a thin layer of greyish shale which when wet with water, separates into parts like lime in slaking.

In the upper part of this rock, fossils are extremely rare; but not so in the lower part. There we meet with many common to the Trenton limestone, such as Lingula ovata, Isotelus gigas, Fucoides dentatus. This latter fossil is rare comparatively in the Trenton limestone, but is extremely abundant in the Black slate and associated with the Fucoides scalaris. There are a few fossils which are peculiar to this rock besides the last mentioned one, among them is the Triarthus Beckii, its characteristic trilobite.

The small veins of Lead ore and pyrites, on the creek near Spraker's basin, are in the Black slate.

Frankfort slate. This rock or mass is the successor to the Black slate; the one changing to the other by imperceptible gradations, the dark or black colour of the lower rock disappearing in the lighter colour of the upper rock. This rock may be seen to the greatest advantage on Frankfort creek, back of the village from whence it takes its name, and also on the waters of the creek which flow by Utica to the southeast of the city, being interposed between the Black slate which there forms the bed and sides of the Mohawk and the "millstone grit," in consequence of the absence of the next three rocks.

The upper part of the Frankfort slate in many places alternates with thin layers of a fine grained sandstone, more or less intermixed with the matter of the slate; both by long exposure to the air assume a dark green or olive colour, by which they are readily distinguished from the Black slate, which changes to a brown.

Fossils are rare in the lower part of the Frankfort slate, but are numerous at the upper part where it joins the next series, the Pulaski shales. To which of these two masses they belong, or if they form a separate mass, has not been determined; but that they form an important geological line of division is certain, for there is no essential difference between the fossils, whether seen at the mill race at Lee centre, or Whitall's quarry, near Rome, Halleck's springs, in Hampton, or the gully near Utica and the Cohoes, near Waterford. In all these localities, the characteristic shells of the Pulaski shales are wanting, and others appear, that had no previous existence in the district. Among the Fossils are cryptolithus, probably the tessellatus Pentacrinites ——— and Trimerus ———.

Halleck's spring was commenced in the upper part of this rock, and it is not improbable that the springs of Ballston, Saratoga and Albany may be in the same rock, (the Frankfort slate,) and for these reasons. The fossils of Waterford show the existence of the upper part of the mass on the Hudson. Secondly, that there are extensive and thick masses of argillaceous rock upon that river, whose age is matter of controversy. Thirdly, that organic life abounded in the period of the Trenton limestone, and disappeared in the lower part of the Black slate, reappearing only at the upper part of the Frankfort slate, leaving a thickness of mud rock, of at least 400 feet, comparatively destitute of organic bodies. Now what cause so well explains this absence of life, as the existence of saline matter, as to kind or quantity, unfavorable to its existence or development.

Pulaski shales. Called in the last report the shales of Salmon river, which we have changed to the first name, from finding them at the village of Pulaski, unaccompanied by any other mass. There the argillaceous part predominates at the lower part of the village, accompanied by some carbonate of lime, whilst above the village we find the sandstone begins to predominate.

The fossil which best characterise these shales are Pterinia carinata and Cyrtolites ornatus. Besides there are others whose individuals are very numerous, as Pterinia planulata, P. Modiolaris, P. pholadis and Delthyris equistriata and others not yet named. Again those which are common to the Trenton series, such as Strophomena alternata, Orthis testudinaria, Bellerophon apertus, Calymene blumenbachii.

These shales form the elevated parts of Lewis county, a considerable portion of the northwest part of Oneida, and the comparative depression which extends from Pulaski to near Jefferson county, bordering on the Lake. Their most southern point is at Talcott's quarry, about two miles southeast of Rome.

Salmon River sandstone. This rock is grey and greenish as to colour, the latter prevailing at the lower part, the former at the upper. Frequently there is a thin coating of green shale upon the lower layers, with and without markings or configurations like fucoides.

This rock forms the falls of Salmon river, in the town of Orwell, and the falls on the same river above Redfield village, and though their elevation be very different, yet they were originally parallel masses. It forms the knobs near Florence village, and the rock of Woodruff's quarry, to the southeast of Rome. It may be seen to the north of the road which leads from Pulaski to Oswego, where we have the upper part. From the falls at Orwell it disappears, descending the river so as to bring the shales of Pulaski in view. This rock furnishes grind stones, near the High falls of Salmon river, and at Woodruff's quarry, as mentioned in former reports.

Medina sandstone. Called in former reports the red sandstone of Oswego. Predominant colour red, more rarely whitish and greenish. This rock is confined to Oswego county, to the high grounds of Oneida at Florence village, and other parts of the town of Florence, and to the extreme north parts of the counties of Onondaga and Cayuga.

In this rock are many brine springs, and it is the lowest deposit of western New-York for common salt.

Its characteristic fossil is Fucoides Harlanii, being abundant at the upper part of it, and exclusively confined to this rock.

Oneida conglomerate. The "millstone grit" of Prof. Eaton, which has been changed, to do away with all ambiguity, there being no other rock of the kind in Oneida county, if we except the thin irregular layers, composed of small sized pebbles, which makes a part of the succeeding group, and which may be seen at Blackstone's quarry, to the south of Utica.

Protean group. This group by the next report will be divided into two, the upper one consisting of the Lockport limestone and its calcareous shales, whilst the lower will embrace the green shales, their associated sandstones and iron ore beds.

This group extends through the third district, forming a part of the high range south of the Erie canal in Montgomery, Herkimer and Oneida counties. By the dip of the rock to the southwest, the rise of the ground, and from the extent of denudation when upon the summit level of the canal, this group ceases to form a part of the elevation, but underlies the southern part of the level, extending through Lake Oneida, and onwards in the direction of the Lake to the fourth district. This group is an highly important one for its iron ore, limestone, sandstone, and from its forming an era in marine botany, for the number and kinds of plants which are found in it.

Its fossils, in the upper or calcareous part of the group, are Orthis bicostata, Delthyris lineatus, Strophomena rugosa, and a few others. From the thinning out of this part of the third district, it contains but few fossils comparatively with the same mass in Mr. Hall's district, where it is of great thickness. In the lower part they are more numerous, but a few only have been determined. The small and peculiar crustacean, the Agnostus pisiformis belongs to this part, being found with the iron ores. So also the Pentamerus elongatus, Strophomena rugosa likewise, being the lowest position of the shell. With these we have the Trimerus delphinocephalus and two other Trilobites not determined.

The greatest thickness of this group must be over 200 feet. In this group we have the third deposit of iron ore, viz. the oolitic or concretionary red oxide.

Onondaga salt group. This is not only an immense deposit, but an highly important group, extending through the third and fourth districts, with a thickness in Onondaga of about 700 feet. It embraces all the salines of Onondaga and Cayuga, as well as all the Gypsum beds of the State. No gypsum or plaster of any consequence has been found east of Oneida creek, excepting in the town of Stark, south of Little-Falls, and this accords with the greatest development of the group which is west of that creek.

It is divided into four parts or masses. "The first or lowest is the Red shale. Second, the lower Gypseous shales, the lower part alternating with the red shale, the red ceasing entirely with this mass. 3d the gypseous deposit, which embraces the great masses quarried for plaster, the hopper shaped cavities," the " vermicular limerock" of Eaton, and other porous rocks ; and 4th, those rocks which abound in groups of needle form cavities, originally occupied by sulphate of magnesia.

Not a fossil has been observed in the two lowest deposits ; they are found, but rarely, in the two upper ones. In the 3d mass at Bull's quarry we find a few small fucoides, resembling spear grass, the Lingula limosa and two or three thin shelled bivalves not yet determined. A small Cytherina in the road from Jordan to Peru, on the south side of the canal. Two species of bivalves are also found at Dunlop's mill, below Jamesville, accompanied by fucoides and a large sized Cytherina, all occurring in a coarse calcareous slate, and I should judge makes a part of the mass which encloses the plaster, being between the upper and lower beds. It is in this slate that I should place the Eurypterus remipes. It has not yet been found within the plaster region, but in the series of the plaster region, below Waterville, and in a rock or mass which extends east through the district, having a gypseous shale below it, and the Manlius water lime series above it.

Manlius water lime group. This group embraces all the beds of water lime south of the Erie canal, which are burnt for cement. It is very constant in its character, and I have traced it from Cayuga lake to the hills in the rear of Hudson. It affords the most profitable limestone for burning of the whole series of limestone rocks, and from this cause it is always chosen when present, requiring less wood to calcine a given measure than the other limestones. From Cayuga to Hudson river, kilns are arranged by the sides or upon the top of this rock.

This group is admirably characterized by its fossils, and before these were well known, its blue limestone was often confounded with the Trenton limestone. Its layers are dark blue and drab ; the latter furnish the water lime, the former the caustic lime. Its fossils are Atypa plicata, Pterinea ———, Stenoscisma bisulcata, Littorina perantiqua, Cytherina ———, Leptæne punctulifera ? Tentaculites, &c. &c. At the bottom of this group, or top of the last, we find the Catenipora labyrinthica.

Pentamerus Limestone. This limestone comes in from the first district as a thick mass, and with numerous fossils as to individuals, but runs out before reaching Onondago valley, its fossil disappearing in some of its localities, so as to make its recognition difficult. Its characteristic fossil is the Pentamerus Knightii, which is usually in great abundance, also, an Atrypa, resembling the Wilsoni and the Euomphalus profundus.

Delthyris shaly limestone. This mass makes its appearance to the east like the former, and ends in a like manner, carrying with it the Delthyris Macropleura, Strophomena rugosa, Orthis resuprinata, Orthis, resembling the Concentrica Delthyris pachyoptera. The Delthyris bilobata, which is peculiar to this rock, I have not yet seen in the third district. The Platyceras ventricosum is an abundant and a characteristic fossil of this rock.

Scutella limestone. This is likewise a rock of the first district, but its fossil being more persistent than those of the two former rocks, it is readily traced to Oriskany falls, the ridge to the east of Minsville and Fosters' mill, on Oneida creek. The peculiar fossil from whence its present name is derived, I have not observed in the third district, but all others that are common to it and give to its character there, exist in the 3d district; such as the Atrypa, resembling the hastata, strophomena tuberulifera, Apiocrinites, Asaphus micrurus, &c. &c.

Oriskany Sandstone, exists, with interruptions, through the district. At Oriskany-falls, it reposes upon the last named sandstone; but from Madison county, west, in consequence of the absence of all the intermediate masses, it lies upon the Manlius water lime group. This rock in its lower part abounds in fossils, and of a large size, showing that at that period the circumstances were highly favorable for the development of this kind of animal life, among them we find the Atrypa elonga, Delthyris arenosa. This rock is the fourth position of iron ore, but not yet found of a quality suitable for smelting.

Fucoides Cauda-Galli. This series so extraordinary for the peculiar fossil which it contains and from whence its name is derived, is also a rock of the first district. It continues through Otsego and Herkimer counties, but further west I have not yet seen it. It is an argillaceous mass in places somewhat sandy, of a black or dark green, which becomes lighter, and by long weathering blanches. It readily strikes the eye by its contrast with the other rocks and by the peculiar markings of its fossil, so strongly resembling the plumage of the male of the barnyard fowl.

Schoharie layers. These layers I have not yet seen in the district, but I have found detached pieces of limestone which evidently were severed from them. These are the layers so abundant in fossils, and have furnished such numbers to the collectors of Schoharie. Among its fossils are Phragmoceras arenatum, Lituites bidulphii, Spirorbis tenuis, Calymene Rowii, &c.

Onondaga limestone. This is the limestone or marble so well known and so extensively wrought, from Auburn to Cherry-Valley. West of Oneida county it is the stone which is used for all the exposed masonry of the enlarged Erie canal.

In the bottom layer of this rock, pebbles of black sandstone are often seen, having been derived from the breaking up of the Oriskany sandstone. These pebbles were concretions in the sandstone, and they may be seen in situ on the farm of Mr. Eastman, on the road from Waterville to Paris Hill.

The Onondaga limestone abounds in Testaceous fossils, the most characteristic ones have not yet been named. It contains a new species of Pentamerus, which is met with in all its localities that I have examined. The atrypa Nasuta is confined to this rock.

"*Corniferous limerock*" of Prof. Eaton. The lower part of this mass often presents a limestone more or less mixed with aigillaceous matter, forming a shaly rock, whilst the upper with few or no exceptions exhibits from one to even ten parallel ranges of nodular flint, whence its name. This occurrence of flint is not peculiar to this rock, for it occurs in the Onondaga, the pentamerus and other limestone rocks but less frequently. It has however two fossils by which it may always be known, the Platyceros dumoso, and the Cyrtoceras ——, many specimens of the latter may be seen in the limestone flags, with which parts of the city of Utica are paved.

Seneca limestone. This is the last of the immense series of limestone and other rocks, which form the northern termination of the great east and west elevation, which extends through the State. All of them from the Manlius waterlime group, are only found on the south side of the Erie canal, and were it not for the deep valley of excavation whose course is north and south, they would merely exhibit a superficial northern outcrop. They all disappear in the order enumerated, one passing under another, and finally the whole are covered in their progress south by the shales and the sandstones which succeed to them, the former sinking deeper and deeper, as newer or higher rocks in the series appear, the whole series or class ending only with the coal of Pennsylvania. The characteristic fossil of the Seneca limestone is the Strophomena lineata. The rock in some localities swarm with them; they are more abundant to the west of Oneida creek, than to the east of that creek.

Marcellus shales. The colour of these shales are of deep black from carbon. In some localities from the accumulation of its colouring matter it appears as well characterized coal, exciting high expectations of abundance by excavation and in every attempt disappointing its explorers. From place to place along the long line of its extension east and west, pits may be seen which were dug for coal.

These shales contain in some localities layers of limestone separated by shale, in others the layers are interrupted from diminution of material appearing elsewhere as Septaria, and finally disappearing altogether. In Oneida Creek and near Manlius square, there are two layers of limestone which abound in Fossils consisting chiefly of Goniatites and Orthocera and confined to this rock. At Cherry Valley, the shales are abundant in fucoides retaining their carbonaceous material, and it is probable that the shales owe their carbon to vegetation of their kind. At Cherry-Valley the shales are interposed or separated by irregular layers of limestone, their surfaces covered with knobs, the result of irregular accretion.

Upper shales of Marcellus. These are less highly coloured than the lower ones. They contain no fossils for one or two hundred feet, or more where thickest. They are disposed to break into small fragments, flat and showing a tendency to a peculiar concretionary structure, exhibiting slight stains from iron rust, owing to minute particles of pyrites. The whole of this mass has been formed from mud, whose particles were of great tenuity. This mass is thickest to the west, thinning out to the east. At the village of Marcellus, Onondaga county, both these shales may be seen to the greatest advantage. Going from

Marcellus to Skaneateles, we find in ascending the shales, that fossils begin to appear, the first is an orthis; a new species appearing here for the first time, and continues with many interruptions through several groups, if there be but one species of it. Still higher we find the shales of Skaneateles, which cover the north end of both sides of the Lake of its name, and which at present we consider as a mass, or series distinct from those above or below.

Skaneateles shales. These are highly fossiliferous, but the fossils do not differ from those of the Moscow shales that I am at present aware of. The great thickness of rock between the two masses is the reason why we at this time separate them.

Hamilton group. In this group we have shales and sandstone, the former dark blue, olive, &c. West Hamilton is the locality where it is well characterized, also Cazenovia, Pompey Hill, &c. being one of the south rocks whose range is uninterrupted through the district, covering considerable ground south and north. In this rock we find the Dipleura, DeKayi, Orthoceris constrictum, Cyrtoceras maximum, Posidonia lirata, Goniatites punctatum, Conularia ——, a large Orbicula, with abundance of Aviculæ, Pterenea, &c. with a re-appearance of the Fucoides cauda galli, should the species be the same. In this group we find many layers suitable for building purposes, and quarries are numerous along its range, being the best stone either north or south, for some distance. Near to Cayuga lake this group is separated from the next one by an encrinal limestone, which is not observable toward Madison.

Moscow shales. These shales are various as to hardness, smoothness, &c. They are found at Tully Four-Corners, under the limestone; Ludlowville, below the falls, under the same limestone; at Moravia, Montville, near Sherburne, New-Berlin, Otsego lake, &c. &c., the range occurring south or above the former group. This is also a highly fossiliferous mass, having plants, with Testaceous and Crustaceous remains in great abundance; among them we find the same fucoid last mentioned, Delthyris undulatus, D. granulosa, D. distans, Orthis concentrica, Strophomena lineata, S. carinata, Crypheus Greenii, C. calliteles, &c. Many fossils are common to the last three divisions, the whole together making a mass which cannot be less than from six to eight hundred feet where the thickness is greatest.

Tully limestone. Fossils are characteristic, but not yet named. The Atrypa —— of the same family as the Wilsoni is only found in this rock. This rock is met with in many places west of Tinker's falls, and is burnt for lime.

Black shale. This mass has very few fossils consisting of an Orthis, two Lingulas and a few other shells. It contains septaria.

Sherburne Flagstone. Found near Sherburne, Chenango county; the flags there being of the finest quality. The stones are of various grades of thickness alternating with greenish or olive coloured shale; Fucoides resembling the stems of plants are frequent in this rock, and also fragments of plants like the grasses. The flagstone mass extends from Cayuga lake through the district.

Ithaca group. Consisting of sandstone and shales, forming a thick mass, highly fossiliferous. Names not given to the fossils. The top part of this mass terminates in a series of thin sandstone flags with fucoides resembling those below the group, and which separates the succeeding group from the Ithaca.

Chemung group. This forms the narrows of the Chemung river, whence its name. Fossils abundant and characteristic.

Montrose sandstone, or sandstone of Oneonta; this is the last or upper rock of the third district; it consists of many veins of gray sandstone, and sometimes of red sandstone; when weathered it exhibits a peculiar structure, to all appearance owing to the manner in which it was deposited from water; in this rock we often find the remains of terrestrial plants, and sometimes they are thrown together in such numbers as to form a thin mass of coal, extending for a few feet, but only an inch or more in thickness; this rock is found in Otsego, Chenango and Broome counties; it covers the whole of the upper part of Susquehannah county, in Pennsylvania, and being there an abundant rock, and surrounding the town of Montrose, I have thought it well to apply its name to this rock.

We regret that we have not been able to obtain the names of more of the fossils which are found with the different rocks, those we have given being but a fraction of the whole number which they contain. One of the difficulties has been the want of a suitable place to unpack and arrange the specimens collected. Another from many of the fossils belonging to like rocks in Europe, to which we find not one but two, and even more names, in consequence of having been described by different persons of different countries, ignorant of the labors of each other.

It is in natural history as in all things else, that the discoverer is entitled to the benefit or advantage of his discovery, and the name which he affixes, is the received or accepted one, if it be appropriate ; that is, for example, should it be one for a species, it must not be given or used in a genus having a specific name of the same kind, for in that case, as confusion would result, and as it was his business to prevent, and he did not, his right, consequently, is lost. No one can doubt the sacredness of this right, but like every practical right or advantage, it often greatly tends to retard the progress of natural history, where concert of action, or knowledge of what each is doing, does not exist. It often happens that two or more may find the same object, and each may give to it a different name, and the difficulty is often still further increased by imperfect descriptions or worse drawings or plates. So incumbered is some parts of the Fossil department, by man's doings, that the labor of collecting the fossils, arranging them in the order in which they occur, giving to each a place, a name and a description, is small in comparison with determining what has been described, and what has not been described ; what name ought to be adopted, and what name ought not to be adopted.

Two reasons have urged me to make the above observations. The desire to make known the difficulties experienced in that part of our duty, connected with the fossil department, and to ascertain what means are best to put that department in the same state of advance, with the other departments.

Secondly, it is possible that the fossil department may seem to many, not only unimportant, but even trivial, and every way unconnected with the interests of man. Such, too, may not be aware that one of the great primary laws of creation is, that effects are but the consequences of causes, and that causes are but the antecedents of effects, proving that all that exists, has existed, and shall exist, are enchained together as parts of one great whole or system, the unravelling of which was given by its great Creator, to the only part of his creatures whom he declared to have formed in his image. Do we not every where invariably find that the power of man increases with every advance made towards unravelling this system; and ought we to neglect even the smallest part of it, since each part is a link of the chain which extends from the least created, to the highest created being.

Annexed is the report of Mr. Carr, assistant of this district, who was aided by Mr. Alfred I. Green, of Albany. These two gentlemen collected 28 boxes of specimens, making, with those collected by myself, 42 in all, for the last season.

LARDNER VANUXEM,
State Geologist.

APPENDIX

To L. Vanuxem's Report.

ECONOMICAL GEOLOGY.

Lake Marl and Tufa.—Several deposites of marl and tufa occur in the limestone region in the northern part of Otsego. South of the limestone range, these deposits diminish in extent and proportion as the calcareous alluvial diminishes. Several small deposits were formerly known in the southern range of counties; but these, from their limited extent, have become exhausted. Along the southern part of the town of Cherry-Valley, at the outcropping of the drab limestone, are several deposits of tufa and marl, which are deposited by streams issuing from the limestone above mentioned. At the sulphur springs, below the falls, north of Cherry Valley, also on the farm of Mr. Schism, in the neighborhood, are deposits of this substance.

Cortland marl ponds.—A short distance west of Cortlandville are three marl ponds which supply the neighborhood with lime. From the remoteness of these deposits to limestone, and the purity and whiteness of the lime when burned, they are highly valuable, and the lime is much sought for by the inhabitants of the more southern counties, for whitewashing and other common purposes to which lime is applied. These three ponds are near each other, and cover an area of twenty-five acres. The quantity of marl in some of these ponds is said to be gradually increasing, notwithstanding the quantity which is continually being taken from them. There are several small marl ponds in the northern part of Cortland county.

Peat.—A few deposites of this substance have been discovered in Otsego county. On the farm of Mr. Clark, two miles south of Cooperstown, is a small peat swamp, nearly surrounded by alluvial hills, covering an area of six acres. The peat is apparently of good quality, and may be made accessible with little expense. Several other small marshes of a similar character are found in the neighborhood. On the road from Cooperstown west towards Oakville, are several small deposits. Two miles south of New-Berlin, on the east side of the Unadilla, is a peat swamp covering an area of forty-five or fifty acres. This is the most extensive deposit of the kind observed. Its depth is unknown ; in several places a pole was thrust down ten feet. It is probably much deeper. This swamp surrounds a small pond which is gradually diminishing from the formation of this substance. The swamp may be drained with little expense. Notwithstanding the value of this substance, as a manure, and its adaptation to the neighboring soil, its presence was heretofore unknown, or value unappreciated. A few other smaller deposits are found in the large north and south valleys.

Bog-ore.—Small deposits of bog-ore are numerous along the principal valleys, but in no place has it been found in sufficient quantities to be of any value. In the neighborhood of Colliersville, in the Susquehanna valley, Otsego county, are several small deposits ; also near Oneonta, Binghamton, Owego, &c. &c.

Clays.—Beds of clay are of common occurrence in all the valleys and low grounds, some of which make good brick, which are burned in proportion to the wants of the inhabitants.

Alluvium.—Beds of sand and gravel are common along all of the valleys. These have nearly always been seen in connection with each other, the sand and gravel alternating, the sand invariably occupying the lowest position. These alternations are well exhibited at Chenango fork, on the opposite side of the canal, and south, for two or three miles ; also, at several places along the Susquehannah valley, from Oneonta to Owego.

Sulphur springs.—These springs are frequently to be met with throughout all the southern counties, and are only worthy of notice so far as the inhabitants have been led into useless expenditure by attaching value to them. North of Cherry-Valley, below the falls, are several springs of this character, which issue from the drab limestone and deposit tufa and sulphur. In the town of Pitcher, Chenango county, are several sulphur springs, which formerly attracted much attention. Two large hotels were built for the accommodation of visiters ; but the novelty soon subsided, and now the hotels and bathing houses are nearly unoccupied. The Nanticoke on a creek of the same name, in Broome county, are like those of Pitcher, at which a large hotel has been erected, but the medicinal properties of these waters, like those of Pitcher, subsided with the novelty of the affair. Near McDonough, Norwich, are sulphur springs which are occasionally resorted to; some of these springs are said to be useful in cutaneous eruptions.

Excavations for Coal, &c.—In addition to the salt borings in Triangle, where upwards of 5,000 dollars have been expended, are several excavations for coal, &c. On Appalachia creek, near Pennsylvania line, excavations have been made in the rock below the Montrose sandstone. The origin of this work may be traced to the divining rod. On lot 26, Broome county, on the road from Harpersville to Binghamton, excavations have already been made, and high are the expectations of those engaged that coal will soon be found in abundance. In several other places search has been made, which in most instances have been given up on information of their futility being given. In the neighborhood of Port Crane, several men in indigent circumstances, spent much time, money and credit, in digging for lead, without the slightest indication of the same, save that of the mineral rod. In all of the cases mentioned, the people have been led to search by witnessing the mysterious effects of the mineral rod, which still in many instances, is far more potent than reason.

Materials for construction.—The green portion of the Montrose sandstone, from its superior hardness, affords a durable material for construction. Several quarries in this rock are opened along the Chenango valley, and many between Green and Oxford. Among the most important, may be mentioned that of McNeal's, four miles south of Oxford, on the east side of the canal. From this quarry are obtained large and beautiful flagging stones, many of which are taken to Binghamton on the canal for this purpose.

The grit of Oxford supplies the surrounding country with grindstones and whetstones; it is also used for mantle pieces, jambs, sinks, &c. Although this rock is not arranged in layers, from its softness it is readily cut into any desirable form. The principal quarries in this rock are those of Simmons, four miles south of Oxford, and Keaches, north of the village.

Erratic blocks.—In the more northern parts of the counties of Cortland, Chenango and Otsego, masses of granite, some of which are of an enormous size, are seen along the road north of Truxton. These diminish in size and number as you go south. In the southern counties but very few were met with, and those small in size. So far as I have been able to determine by observation, in the southern counties particularly, as well as in the more northern, they are principally confined to the hills and rocks found in the vallies ; their position is such as to favor the idea of their having rolled down from a higher level.

EZRA S. CAR, *Assistant.*

FOURTH ANNUAL REPORT

Of the Survey of the Fourth Geological District, by James Hall.

To His Excellency William H. Seward,
Governor of the State of New-York.

Sir:

I have the honor to present the following report of the progress of the survey in the Fourth Geological District.

The counties which form the subject of the present report are Steuben, Allegany, Cattaraugus, Livingston and Genesee. Erie and Chautauque still remain to be examined, besides some portions of Cattaraugus, and a re-examination in other counties, which will be the subject of the next annual report.

The rocks which come within the limits of the counties examined the past season are the Onondaga saliferous group, including the plaster beds, the hydraulic limestone, the Onondaga and Seneca limestones: to the last succeeds the thick group of fossiliferous shales, known as the Marcellus shales, dark slaty shale, compact calcareous blue shale, olive shale, the shales of Ludlowville, the shale of Moscow and the upper black shale.*

With the absence of the Tully limestone, another stratum, though of inconsiderable thickness, becomes more fully developed. This is a crinoidal limestone, which always holds its place between the Moscow and Ludlowville shales, and extends throughout the fourth district. It may be termed crinoidal limestone, "*par excellence*," for the stems of encrini are often one or two feet in length, and many of them an inch in diameter. This mass has often been mistaken for the Tully limestone, in the western part of the State, and thus given rise to some confusion regarding the rocks above and below; but this difficulty I have been able to explain. All the cited localities of the Tully limestone, west of the Genesee river, exhibit only the crinoidal limestone, and instead of being between the Moscow and upper Black shale, is below the Moscow, and between it and the Ludlowville shale. This fact readily accounts for the highly fossiliferous shale above the supposed Tully limestone on Lake Erie.

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* The Tully limestone does not form a member of the series in the counties under consideration, though its place next above the Moscow shale is easily identified. From the absence of this limestone the upper black shale succeeds the Moscow shale.

The group mentioned in the report of last year as succeeding the upper black shale, and consisting of sandstone, shale, &c. developed on Cayuga and Seneca Lakes, and more particularly at Penn-Yan, becomes on the Genesee, a mass of green crumbling shale, of one hundred and ten feet thickness. It is exposed on the Cashaqua creek, above the junction of the Genesee Valley canal and the Dansville branch, and at the Shaker's Mill, on the same stream; hence the name of Cashaqua shale.

When first quarried this rock appears in thick masses, which, after a little weathering, falls into cubical or angular fragments. It contains, occasionally, thin concretionary layers of sandstone; these are not continuous, and may be no essential feature of the rock. The fossils are two or more species of Cyrtoceras, a large and beautiful species of Pterinea, Orthis, Posidonia, &c.

In the order of succession the Ithaca group follows the Cashaqua shale; but in the Genesee valley, and the counties examined this season, that group is entirely wanting, and will probably not be identified farther west than Seneca Lake. The Cashaqua shale is succeeded by a thick mass of shale and flagstones, or thin strata of sandstone, at intervals of a few feet, and often a few inches. The sandstone layers do not often exceed six or eight inches, and generally are not more than four inches in thickness. In the lower part of this mass the under surfaces of the sandstone are covered with large straight fucoides, and often present the appearance of having been deposited on a surface of shale, which had previously been smoothed and slightly scratched by running water, bearing light and fine materials in its current. Throughout the greater part of this group the lower surfaces of the sandstone strata are covered with short, rigid fucoides, of the size of a pipestem and larger. These are generally not more than four or five inches long, and so arranged as to present a rude imitation of Hebrew characters. Along the Genesee river this group commences a short distance above Mt. Morris, and continues to the lower falls at Portage. Along this whole distance it may be seen rising into perpendicular cliffs, of from one hundred to two hundred and fifty feet in height, and is only partially obscured in a few places by land slides. From being more extensively exposed along the Gardeau Reservation than in any other place I have seen, I give this the name Gardeau, or *Lower* Fucoidal Group, in contradistinction to one above, next to be described.

In following up the bed of the Genesee river from Mt. Morris to Portage, a place presenting an assemblage of magnificent scenery, scarcely surpassed, we find a decided change in the rocks, commencing with the platform or table rock of the Lower falls. The sandstones below are fine grained, and generally one side covered with a glazing of shale, while the table rock has no glazing of shale, is coarse grained, and presents a different aspect. The latter also abounds in a species of Fucoides, which for the most part is vertical, apparently having been growing on the muddy bottom, while the sand was deposited quietly around it, proving at least a nearly quiescent state of the waters of that period. This species of fucoid scarcely exceeds in size a common pipestem, apparently very flexible, though we rarely find them curved. Occasionally, indeed, they appear as if the tops had been bent downwards and fastened to the bottom, while the sand enveloped them in that position, the stem presenting in the stone a portion of the circumference of a circle or ellipse. This species of fucoid is found in nearly all the sandy strata from the Lower falls upward to the top of the group, the upper rock of which is a mass of sandstone, more than one hundred and fifty feet thick. It is in this mass of sandstone that the tunnel for the passage of the Genesee Valley canal is being excavated. At the northern extremity of the tunnel, where the rock is uncovered, the surface presents numerous round dots, which are the ends of the fucoides, and which, on breaking the rock, are found to proceed downwards, developing the stem for many inches. At this place also, the surface of the sandstone is much worn and scratched, as if by a powerful current, bearing heavy materials. This may be termed the Portage or *Upper Fucoidal Group*. There are no other rocks in the district better characterized by fossils than the two groups just described, and the fucoides are almost the only fossils contained in them.

The two groups just described, occupy a thickness of more than 1,000 feet, and are interposed between the Cashaqua shale and the Chemung group. Indeed, if we consider the Chemung group as commencing with the occurrence of its characteristic marine fossils, then several hundred feet more of rocks may be noticed as intervening between the upper Portage rock and that group.

The rock succeeding the upper Portage rock, consists of greenish olive sandy shale, or very shaly sandstone, the whole mass of a homogeneous appearance, and never slaty. The only fossil seen in this rock is a species of fucoides with a striated surface, and these are by no means numerous. This is succeeded by a dark, nearly black, sandy, highly micaceous shale, with septaria. It contains iron pyrites, and where exposed, is of an iron rust colour, externally. Some thin masses of gray sandstone are interstratified, which contain fossils referable to the Chemung group. The Chemung group occupies a large area in the southern counties, and with the exception of a small thickness above, forms the highest mass in these counties.

The Gardeau and Portage rocks are well entitled to the place of distinct groups, both from their general mineralogical character as well as from their fossils, both differing from rocks above and below. In the Portage group, a single specimen of Cyrtoceras has been found, and in the upper part of the Gardeau rock, a few of the fossils of the Cashaqua shale were found; but this must be considered accidental, and forms no character by which the rocks may be identified.

In some of the upper sandstone strata of the Gardeau group, there is an apparent tendency to concretion, though the masses are distinctly laminated. The upper surface of the stratum appears as if it had been compressed while soft, and exhibits numerous irregular concave depressions, the stratum thinner at this point, and the laminæ apparently more closely compressed. There occur in the shale of this part of the group, nodular or concretionary spherical masses, of from six to twelve inches in diameter; these masses usually consist of a solid nucleus, and at the outside to the depth of two or three inches, radiating outwards; when broken, these radiating portions present somewhat the appearance of the lignilites or magnesian striations in the hydraulic limestone. Some similar cause may have produced these, but it cannot be entirely the same. The same substance sometimes takes the form of thin interrupted courses in the shale, and the concretions are generally much flattened.

These groups are found in greater or less perfection throughout the fourth district; their maximum thickness is probably in the Genesee valley, from which place they gradually diminish in thickness east and west.

At the commencement of my labors the past season, my first object was to ascertain, if possible, a definite termination to the upper groups noticed in the report of last year, and also, something which would show more clearly and conclusively the connexion of these groups with the coal measures, as well as the characteristic and decided separation of the two. In following up the Tioga river beyond the limits of the State of New-York, I found the Chemung group succeeded by a red sandstone, which for the most part would pass for a rock destitute of fossils, but which however contains some peculiar remains which will be noticed directly. The commencement of this rock, and the upper limit of the group below, is well exhibited near Tioga, Pa. and also near Covington. Above the red sandstone we have greenish and grey sandstones which are succeeded by the rocks containing coal.

To Mr. Taylor is due the credit of pointing out the existence of this rock, and its analogy to the old redsandstone of Europe. This analogy is farther confirmed by the fossil remains of the rock, which I believe have never before been noticed. In tracing this rock westward we find it bordering the southern limits of the State and in Alleghany co. extending north of the line. It apparently thins out in this direction as the only representative we find of it on the Genesee river is a mass of about six inches thickness, containing a large proportion of iron in its composition which gives it more the appearance of an iron ore than a sandstone.

In several places where this rock is exposed along the Tioga river, it contains fragments of bones, and scales of a fish, which prove on comparison to belong to the Holoptychus nobilissimus, of Agassiz, and which is a characteristic fossil of the Old Redsandstone, of England. It contains also the remains of another fish, the scales of which are larger than those of the Holoptychus. These scales in form resemble those of the Lepidotus. The length of the scale is two inches, and the breadth exceeds an inch and a half. The broader and greater part of the scale is covered with a substance resembling shagreen, while the narrower portion is slightly punctured as if small spines or bristles grew on it. The fin is about ten inches long and imperfect. It probably belongs to an undescribed genus of sauroid fishes.

The thickness of this rock on the Tioga exceeds 400 feet. Owing to an uplift producing an anticlinal axis near Covington, the thickness of the rocks between the coal measures of Blossburgh and the New-York line, has been over rated.

Passing westward the redsandstone is not equally a guide to the proximity of the carboniferous strata, as just noticed, it thins out rapidly in this direction, and I have not yet identified it beyond the Genesee. At this place, near the mouth of Dyke creek, at Wellsville, it contains fragments of bones resembling those at Tioga. They appear as if transported with the materials of the rock, which consists of sand or fine pebbles, bearing evident marks of the wearing action of water.

This rock forms the limit between the Silurean and Carboniferous systems and may be regarded as one of the most important of the whole series. All the coal deposits of any importance will be found above this rock, and from what we now know, none of them extend within the limits of our State in the Fourth District. When this rock shall have been farther examined, and its characters and associations better defined, it will doubtless prove to hold the same relations to all our coal fields, as its equivalent does to the same rocks in England.

Since the publication of Mr. Murchison's work, we have been enabled to establish with great certainty, the analogy of our rocks with those of the Silurean system, as developed in England and Wales. In this country, however, the greater undisturbed range, and apparently better developement of particular members, with more numerous species of organic remains, enables us to limit our subdivisions within narrower bounds, and thus offer greater facility for the study of particular groups. Since, then, all obscurity in this system of rocks is removed, we may go on with more confidence and satisfaction in our examinations, every observation adding to our convictions of the perfection of order of arrangement, and to our admiration of the grandeur and beauty of the whole. The publication of Mr. Lyell's Principles of Geology was termed an era in the science, and the same may be said of Mr. Murchison's work ; it forms an era and an important one in the development of the older fossiliferous rocks which have been so long enveloped in obscurity. It offers inducements to the study of the same which have never before been presented; since, particularly in this part of our country the rocks of the Silurean System are better developed than any other; while the means of studying them with guides have been entirely wanting. Thus the student, after weary months of labor, abandons the subject in despair, being unable to identify the rocks or fossils with any system heretofore published, and having made too little progress to systematize the whole, distrusts what he does know, because it seems inapplicable to what he supposes the same rocks or their equivalents in another country.

The descriptions of the counties are given in the order in which they were examined, it being more convenient to describe them separately than together, besides the facility for reference which it affords.

STEUBEN.

The topographical character of this county I have heretofore had occasion to notice. On the level of the higher grounds, the surface is only moderately uneven, and except the ravines and water channels, presents a gently undulating or rolling appearance, being by no means the rough and broken country which has been represented or might be inferred from travelling along the main roads in the valleys, with the steep escarpments of the hills rising on either side.

Nearly all the ravines and banks of streams in the northern part of the county exhibit the upper and lower Fucoidal groups, and they have already been described, as seen at Hammondsport and at Reading, in the eastern part of the county, also at Conhocton and Dansville. The middle and south are occupied by the Chemung group, which extends to the southeastern part, and thence into Pennsylvania, while in the more elevated lands of the west, this group is nearly or entirely limited within the county, and is succeeded by reddish or chocolate colored shales, which approach the Old Red Sandstone. These shales in some places contain a few fossils, which may possibly identify them as belonging to the Old Red system.

In Conhocton, a mile south of Bloodscorner, rocks appear in the point of the hill, which divides the valleys towards Liberty and Dansville; at this place they are sandstone and hard sandy shale, which crumbles but is not slaty. The layers of sandstone are used for purposes of building. The fossils found were a few imperfect shells of Leptæna and crinoidal joints. From this place, south to near Liberty

Corners, fragments of similar rocks are scattered over the side of the hill forming the western slope of the valley. These probably belong to the lower portions of the Chemung group, and succeed the Fucoidal masses of the north. One mile north of Liberty-Corners, on the hill east of the valley and river, appear many fragments and large masses of a highly calcareous rock almost entirely composed of fossil shells of Leptæna, Orthis, and Delthyris. This is used for a fire stone, for which by its crystalline and seamy structure it is well adapted. I have not been able to find the rock in place, but the position of the numerous fragments gives evidence that it is not far distant.

From Liberty Corners to Bath, along the valley of the Conhocton, few rocks appear in place ; the hill sides, though often abrupt, are covered with soil, and in many places strewed with flat and angular fragments of rock, evidently from a mass not far beneath. Nearly all the declivities towards the deep valleys are similarly covered, like the talus of a cliff on a lake shore ; and probably the cause was the same. The water when at nearly or quite the elevation of the tops of the present hills would wear away their rocks, fragments of which falling down without being subject to erosion by transport, would cover the declivity. A section of almost any of our lakes, with their banks, will present analogous appearances, except that the water has remained longer and worn the fragments more in the present than in the ancient lakes.

The rocks of Bath and its vicinity and thence to Painted Post, have been described in a previous Report. During the past season, they have been more exposed in quarrying for the thin courses of sandstone which are intercalated between thick masses of shale. They all belong to the Chemung group ; those south of Bath consisting of greenish blue sandstone, with grey and greenish sandstone below, contain the characteristic fossils of that group. On the Tioga, above Painted Post, more minute examinations were made at the rail road cutting ; and a section exhibiting in detail the changes and varieties of the rocks exposed. Four miles south of that village, a greenish and brownish shale with brown sandstone is succeeded by concretionary strata. This mass is entirely destitute of fossils, not even a trace of such being found ; while manganese infiltrations are abundant, and almost every fragment of shale exhibits beautiful forms, resembling delicate vegetable structures. For several miles south of Painted Post, except in the cut mentioned, no rocks in place are visible, though the hill side is covered with fragments which denote the character of the rocks beneath.

The high banks on either side of the river valley expose the outcropping edges of the strata, and numerous small quarries are opened for the extraction of the thin layers of sandstone every where interstratified with the shale. The hills are capped by thin layers of sandstone, with less shale than below, reddish or brownish in color, with abundance of scales of mica. These upper portions, so far as observed, are less distinctly characterized by fossils.

The rocks, at the south line of the State and near the river level, consist of hard thick strata of grey sandstone, a part containing abundance of Leptæna and Delthyris, and succeeded by a thick concretionary mass. The grey sandstone forms a fine material for building, and more durable than any other in this part of the country. Farther west and a little south of the county line, a thick mass of concretionary sandstone, with regular strata of grey sandstone is seen in the north bank of the Cowanisque creek.

In order to give any definite information regarding the connexion of these rocks with those of known character above, I have found it necessary to extend my examinations as far as Tioga, Pa. seven or eight miles south of the State line. At this place the upper member of the fossiliferous group of New-York passes beneath the Old Red Sandstone, dipping south at an angle of from 6° to 8°. The Old Red Sandstone, which I shall have occasion to refer to in the description of other counties, is at this place about 400 feet thick, brick red in color, with beds of softer or shaly rock of the same color, and contains fucoids and bones of fishes.

The Old Red Sandstone approaches the south line of the county towards its western limits; and may possibly extend within on some of the highest hills.

In a section made from Dansville south through the valley to the Canisteo, and thence along Bennett's and Troup's creek to the south line of the State, nearly the same kind of rocks prevail in the same order of succession; also in the valley from Patchins to Loon lake and Howard.

The valley of Loon lake has already been mentioned as the continuation of the Hemlock lake and Springwater valleys. In the neighborhood of the lake, large accumulations of alluvium rise in rounded hills 50 or 60 feet above the general level, and skirt the valley on either side; while beyond, the hills containing the rocks rise to a much greater elevation. The commencement of the fossiliferous strata of the Chemung group is at a little distance north of Loon lake. Few sections are exposed, and our observations are limited to the loose masses on the surface, and a few shallow ravines where five or six feet of rock are seen.*

Several places on Neil's creek, south of Loon lake, exhibit good sections of rocks consisting of grey siliceous sandstone with Leptæna, Delthyris, &c. and alternating with beds of shale. These points are near where the creek turns from a southern to an eastern course; again two miles further east, and at Rice's Cottage tavern, similar masses of sandstone, both siliceous and shaly, are found upon the surface from near the mouth of Neil's creek, to Howard. These rocks are doubtless the same strata which occupy the hill tops about Loon lake; though at this place 200 feet higher. The exposed edges of the strata split into thin layers, but if penetrated beyond the reach of weathering, it would probably afford good building stone.

The country known as Howard Flats, is formed of alluvial hills and ridges but little elevated above the general level; and being a high and not well defined valley, presenting outlets in various directions. I could not ascertain the depth of the alluvium, but the deepest wells do not reach its termination; and the absence of an impervious stratum in the gravel renders it often difficult to obtain water in sufficient quantities.

In passing from Howard to the Canisteo valley, at Hornellsville, we cross the highest hills in this part of the county. The rocks consist of portions of the last group; shaly sandstone, shale and siliceous sandstone, all containing fossils, are found along the whole distance.

The northern alluvium, confined to lower levels, is not seen along the road from Howard to Canisteo; and the soil is a clayey gravel formed from the substrata and not highly water worn. In descending into the valley of the Canisteo, we again come upon the northern alluvium, which is the soil of the valley, and covers the lower slope of the hills.

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* Loon lake is situated in a high valley; the hills on the east and west rise to a considerable height, but on the north and south there is almost a continuous level, forming an extensive swamp; the lake has no immediate outlet, but its waters supply Neil's creek which rises in the swamp, half a mile south. From the north end of the lake an artificial outlet supplies water for mills, and is continued as far as Patchins,

From the village of Dansville, south, we find the same succession of rocks. The lower Fucoidal group is well exposed along the Canaseraga creek for six miles south of Dansville. The sandstone layers containing the fucoids are hard and furnish excellent flagging stones. South and above the latter, we find the upper Fucoidal group ; visible at intervals along the road to Arkport; and at Whitney's falls, just within the line of Alleghany county, a portion of this group, more than 100 feet thick may be seen, with the peculiar fucoid penetrating the strata vertically.

One mile west of Arkport, where the Canisteo river comes into the valley from the west, appears the first evidence of a change from the Fucoidal groups below, to the Chemung group above. This is, by the presence of a small coralline (Aulopora ?) which is found abundantly in the Chemung group further east. In following the valley of Canisteo from this point, the descent nearly corresponds with the dip of the strata ; consequently we observe few changes, and none but the lower rocks of the Chemung group are visible before coming to the mouth of Bennett's creek. Along this creek, sections of rocks appear at intervals, and consist, as the others, of sandstone and shale, each in turn predominating, though more generally the shale. Five miles from the Canisteo, on Bennett's creek, there is a thick mass of sandstone, overlaid by calcareous sandstone, containing abundance of fossils of Leptæna and Delthyris. The stone is very firm and durable and easily quarried, in blocks of necessary size for bnilding ; and the part containing fossils is much used as a fire stone, in the backs and sides of fireplaces, ovens, &c.

Nine miles from the Canisteo, at La Grange, in the town of Greenwood, the rocks are seen both along Bennett's and Rigg's creeks; and at the point of land near their junction are several strata of sandstone, proper for grindstones. The whole thickness is from eight to ten feet, and the layers from two to eight inches. Seven hundred dollars worth of grindstones have been obtained from this quarry in one year, and only fifty feet of the courses opened; and should the demand warrant it, the supply might be increased ten fold.* In ascending Rigg's creek, these strata disappear beneath the surface, and are succeeded by greenish shale, with thin layers of silico-calcareous rock with fossils. This shale contains iron pyrites and decomposes rapidly. The grindstone strata are visible on the west bank of Bennett's creek, and extends a mile north to Rock creek, and were also traced up the latter a mile above the junction. Its outcropping edges are found in the hills farther north; but the better situations for quarrying are along the banks of the small streams. The character of the mass is, however, variable, and its fitness for grindstones cannot, in all places, be relied on. At the mouth of Rock creek, it is much harder than at the quarry on Rigg's creek.

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* This quarry belongs to Mr. Benjamin F. Brundage, to whose kindness and hospitality I am indebted for facilities in examining the rocks of this vicinity.

The exposed portions of the strata are greyish brown, slightly stained with iron, rather porous and soft, and containing scales of mica. The rock above and below the grindstone portions is green shale; this below abounds in some places with fossils, as at Rock creek; Delthyris, Leptæna, Pterinea, Orthis, Lingula and Orbicula are here found. Above, the green shale, fifty feet thick, is not fossiliferous. It contains some thin layers of sandstone, and is succeeded by a stratum of sandstone about ten feet thick. This latter contains fossils, while the grindstone mass embraces few or none. The upper sandstone is also more coarse and hard than that below, and well fitted for building, underpinning and ordinary fire stone. This is again succeeded by greenish shale. This point is between 400 and 500 feet above the Canisteo, and 1,500 feet above tide water.

The source of Bennett's creek is about 800 feet above the Canisteo, and the surrounding hills are several hundred feet higher. On the land of Mr. Davis at LaGrange, a salt spring rises in the green shale; the water is turbid and emits bubbles of hydrogen gas. Several years since salt was made at this place, and previously by the Indians. There are, however, no inducements for digging, for so far as we know, no salt springs of importance are found in this rock, and it is probably only such a one as might occur in any marine formation.

While in this neighborhood, I heard of a vein of lead ore, from which the Indians formerly obtained a supply, and lately re-discovered by one of the inhabitants. The locality being kept a secret, I obtained of the person who was said to have discovered it, a piece of the ore, which proved to be a soft talcose rock, the talc in shining scales. This of course could have been obtained only from a boulder; but either from ignorance or intention to deceive, it was represented as coming from the bed. There are many respectable and intelligent persons in this and adjoining counties, who fully believe in the existence of veins of lead ore, from the prevalent tradition that the Indians formerly obtained it in the vicinity. This, like many others of the kind, is unfounded; there being every reasonable proof that no lead ore exists, except it be in minute particles, scattered through a great mass of rock. The assertion, also, that the metal was cut out with an axe, proves the story to be a fabrication, as the common ore of lead is brittle and cannot be cut in this manner.

Four or five miles south of the village of Lagrange, a sandstone is quarried on the land of Mr. Marshall, and used for hearth stones, tombstones, &c. Grindstones are obtained in Canisteo, on the land of Mr. Carter; in Woodhull, on the land of William Stroud, Esq. and elsewhere; in Jasper, on the land of Col. Towsley. These quarries supply all the surrounding country. They are of great economical importance; and the occurrence of similar rock in so many different places renders it probable that the mass is continuous.

From Lagrange I proceeded southward and passed over to the head waters of Troup's creek. In the bed and banks of this stream about three miles from the Pa. line, sandstone and green shale appear; the sandstone contains a mass of one foot thick, composed of shells of Delthyris; the shale contains shells, crinoidal joints and corallines. Farther south on the stream, the rocks are principally reddish or chocolate colored shales and sandstones, with a few fossils. This mass forms the highest rock in this part of the country.

The dip of all the rocks is to the south, at a mean of less than one degree. They are all highly bituminous, and the surfaces of many of the springs are covered with petroleum.

ALLEGANY.

The general elevation of this county is higher than Steuben and Chemung, while the rocks are the same; a difference produced both by a greater thickness of the mass, and a dip to the east or southeast.

The northern portions of the county are occupied by the lower and upper Fucoidal groups, or the Gardeau and Portage rocks; the lower of the two is however rarely visible, except in deep ravines or water courses. The upper portions of the Portage rocks form the cascades and deep escarpments along the line of their northern outcrop; in many places extending beyond the limits of the county into Livingston, and Genesee. At the falls on the Canaseraga, in the town of Burns, the Portage rocks are much exposed; but it is at Portage, as has been before described, that these rocks are fully developed, and may be seen in perpendicular cliffs, from 200 to 350 feet high. The same rocks are traced along the Genesee valley for several miles, when they are succeeded by the olive shaly sandstone and black micaceous shale, which occupy a part of the towns of Eagle, Pike, Centreville, Burns and Portage. The thin layers of sandstone interstratified with the black shale, and also those usually succeeding it, are quarried on the Wiscoy a mile west of Pike Centre, near Pike Hollow, and at many other places along the outcrop and in the ravines and valley sides.

The upper part of the Portage group consists of a mass of slightly argillaceous sandstone, compact and fined grained, from 150 to 200 feet thick ; in some places containing pyrites which stains the rock an iron rust color. This sandstone is quarried in blocks from one to three feet thick, and of any required size ; it breaks easily when first quarried, but becomes very firm when exposed to the vicissitudes of climate.

The Tunnel, at Portage, is excavated in this rock, and the bank of the river above exposes it for 150 feet, where it is cut for the passage of the canal ; and again it appears at the west end of the bridge at Portageville. At these places large quantities of the rock are quarried and dressed in blocks of various sizes for use on the locks, aqueducts, &c. of the Genesee Valley canal. At two or three other places within three miles south from Portage, the same rock is quarried in the shallow ravines along the valley of the Genesee river.

The requisition for stone along the line of the Genesee Valley canal has greatly increased the value of good quarries, and even indifferent ones yield a large profit.

Succeeding the black micaceous shale, are the sandstones and shales constituting the Chemung group, which is every where visible in the ravines and banks of streams. Its northern limit extends through the southern part of the towns of Centreville, Hume, Grove and Burns, and its characters are better developed in the next range of towns. In this county, more particularly along the Genesee river and west, the group differs in lithological characters, and consequently in some degree in fossils, from the same rocks in Steuben and Chemung ; the latter containing the more sandstone, and the shale having an admixture of siliceous matter, that renders the whole harsh to the touch. In the ravines along the Genesee river, a much larger portion is pure aluminous shale, of a deep green or bluish green color ; in this, at intervals, there are courses of nearly pure sandstone ; sometimes a single layer of a few inches, at other times several, forming a mass of four to ten feet thick.

A very good exhibition of this group, and better than is elsewhere seen, in Allegany county, is on the Caneadea, from Rushford, near McCall's mills to the mouth of the creek. The rocks consist of numerous alternations of shale and sandstone, the latter often in layers of two or three inches, and other larger ones, which are quarried for lockstones, building stones, and grindstones.

The following section commences near McCall's mills and terminates near the level of the Genesee river. The numbering is from the lowest to the highest rock :

	Feet.
17. Hard siliceous sandstone, in thin courses, often having lines of irregular deposition and slightly conglomerated,	20
16. Bluish green shale, with thin layers of Fucoidal sandstone,	15
15. Green micaceous shale,	15
14. Thin layers of sandstone separated by shale,	2
13. Shale like No. 15,	15
12. Shale, with six thin layers of sandstone, the lower layer of eight inches, being irregularly deposited,	14
11. Green sandy micaceous shale,	9½
10. Sandstone, the surface corrugated as if water had evaporated from it while yet soft. (A few rods east of this point the layer thins to 4 inches.)	3
9. Greenish shale like No. 11,	10
8. Sandstone quarry, grindstone grit. (Farther west this mass consists of two layers of sandstone, each one foot thick, with four feet of shale.)	8
7. Greenish shale,	12 to 15
6. Concretionary sandstone, the upper portions sometimes regularly stratified, (variable in thickness,)	8
5. Greenish and somewhat micaceous shale. The upper 20 feet is traversed by irregular, vertical and inclined seams, distinct from joints, which cause it to split in those directions, presenting a surface as if chopped with an axe. A striated fucoid is common to this part of the mass. The	
Carried forward,	313

	Brought forward,	
	lower portion contains some fossil shells, the first seen in the section, the upper strata being destitute of any fossils except fucoides,	100
4.	Sandstone in two courses, variable in thickness, quarried at a bridge above Bannister's grindstone quarry, and used for aqueduct stones,	3
3.	Frequent alternations of thin layers of sandstone with green shale, fossiliferous,	40
2.	Green shale, with numerous fossils, shells, and fucoides,	70
1.	A mass consisting principally of green shale, with occasional very thin layers of sandstone. Few fossils in the lower part of the bed. *Not accurately measured*, probably more than	100
		447½

The fossils of the green shale are a few thin shelled Pterinea, Orthis and Delthyris, and a striated species of fucoid is constantly present, both in the shale and the layers of sandstone. In the upper part of this section, there is another species of fucoid, vertical to the strata, presenting in the numerous and closely arranged stems, a slight resemblance to a syringapora.

The surface of No. 10 has the appearance of a muddy sand, after the evaporation of a shallow pool of water; the surface presenting little irregular depressions, divided by angular ridges. I have also noticed a similar appearance, though not to so great extent, in some of the other sandstones.

Nearly all the sandstones of the above section, when of sufficient thickness, are fit for building stone. The upper stratum, No. 17, is the most purely siliceous, and consequently the most durable. No. 4 consists of two courses, one of them two feet thick, easily quarried and dressed; and used in large quantities on the canal. No. 8 contains several courses of variable thickness; it affords a good material for grindstones, for which it is quarried on the land of Mr. Bannister. I did not learn the amount annually taken from this quarry, but judging from the numerous and distant points where the "Rushford grindstones" are sold, it is greater than any other in the district. The stones are drawn to a mill on the stream near the quarry, and after being roughly rounded are placed in a lathe and turned smooth.

In the western part of Rushford, the sandstone, No. 1, of the section, is extensively used for cellars, walls and foundations. The stone is here taken from the loose masses that lie on the surface, particularly on the northern slopes of the hills. Portions of these masses present a slightly conglomerated appearance; the pebbles generally do not exceed the size of a pea, and many times the mass consists of rounded grains of sand not larger than a mustard seed.

Rocks similar to the last, but none of the same strata, are seen in Black creek, Crawford's creek and White creek. In the banks of Black creek, at Rockville, some thick masses of sandstone alternate with green shale, which is slightly calcareous and contains abundance of fossils. The most numerous of these is of a mytiloid shape. Two of the sandstone masses are about six feet thick each, and divided into courses of from two to three feet. They are quarried, for use on the canal, under the direction of Judge Chamberlayne and Mr. Dimock. This sandstone contains a large proportion of moisture, and requires to be quarried and dried before exposed to frost, otherwise it is liable to crack.

Similar sandstone is quarried half a mile southwest, on the line of the canal; it contains fossils of Orthis and Delthyris; and a mile and a half south, and 60 feet higher than the last, a sandstone is exposed on the bank of a small stream. The layers are thin, but extremely siliceous and durable.

The rocks at Rockville are all highly bituminous, the sandstone so much so that it scents the clothes of the workmen; and the water of the springs, though clear, has the taste of bitumen.

Southeast of Rockville, on White creek, we find a greenish shale, with a concretionary sandstone, which in some places becomes a conglomerate in the upper part of the layers. When not concretionary it is fit for grindstones. Sandstone appears in nearly all the ravines in this neighborhood.

The bed of the Genesee river, at the Transit bridge, is in a mass of very fossiliferous sandstone, some portions of which are slightly conglomerated.

At Hull's mills, near Angelica, the rocks are exposed in the bank of the creek, for 50 feet or more in height. They consist principally of shale, which contains the fossils common to the Chemung group, with others, the large pecten-like Avicula. The lower portion of the mass is a hard grey sandstone, containing, in some parts, great numbers of fossils, among which Delthyris and Leptæna are most abundant. A species of Orbicula is also very numerous, and a species of Pterinea ? noticed only at the transit bridge and at this place. This sandstone has been quarried for purposes of building ; it is durable and presents a very good appearance.

About a mile and a half south of Angelica, sandstone has been quarried, though the greater portion of the rock exposed is shale. The sandstone has been used in the construction of a mill near the quarry ; portions are at first extremely friable and scarcely cohere. Like most sandstones of this region, it contains a large proportion of moisture.

Van Campen's creek, near Hobbieville, exhibits shale and sandstone strata, somewhat similar to those at Angelica, but less abounding in fossils. The only peculiar one at this place, is a large Orbicula ; the others are of the usual kinds found in all the rocks of this region. The sandstone along this creek was quarried by Judge Church, and used in building more than thirty years since ; it still remains firm, though somewhat iron stained from the decomposition of pyrites.*

At Philipsburgh, two and a half miles south of Hobbieville, we find a change in the rocks, which is indicated by their fossils more than their lithological character. Green shale is the predominating portion of the mass, and with some, thin strata of sandstone occupies the bed of the river for an eighth of a mile, and together with the vertical bank, presents a thickness of 40 feet or more. The strata dip at a little more than 60 feet in the mile, or nearly one degree. The upper strata of the mass are sandstone, the lower part of which is concretionary. The lower half of the whole mass contains a great number of fossils, many of them characteristic of the Chemung group, and several others which have not been collected elsewhere. The sandstone containing fossils is hard and durable ; this, as well as some of the softer portions, has been used in constructing the dam at this place.

Above Philipsburgh, on the Genesee, rocks similar in character occur in several places in the bed and bank of the river. At Vandermark's

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* My acknowledgements are due to Judge Church, as well for his hospitable entertainment as for many valuable facts regarding the geology and agriculture of Allegany county.

Creek, five miles from Philipsburgh, we find the green shale, not so highly fossiliferous, and with it thin courses of coarse-grained sandstone, containing abundance of a large species of Delthyris. This fossil occurs in a rock of similar texture in many places of the same elevation, and may be found to constitute a definite point, or to mark the termination of some group; certain it is that along this line we find scarcely any fossiliferous rocks above it. This sandstone, and the contained fossils, very much resembles that near the south line of the State, on the Tioga river, and again on Troup's creek, in Steuben; and loose masses are found at intervals along nearly the same line from the Genesee river to the eastern limit of the District. In all cases where we approach the State line south, there is greater difficulty in ascertaining the connexions between rocks. The ravines and water courses are not so deep, and the natural sections are not so well exposed.

The next place south of Vandermark's creek, where rocks are seen, is on Dike creek, near Wellsville, at an elevation of 60 or 70 feet above the Genesee, and between 1500 and 1600 feet above tide water.

The rock at this place consists principally of grey sandstone, embracing a brick red or brownish mass six or eight inches thick. This is composed of sand, or rounded particles of quartz, with much argillaceous matter, splitting into laminæ, half an inch or an inch in thickness, and is so highly impregnated with iron that it stains the hands nearly as much as the Oolitic ore of Wayne county, but is not, like that, unctious to the touch. It is considered by the inhabitants as a stratum of iron ore; but its specific gravity proves the proportion of metal to be too small ever to repay working. Single joints of crinoidea occur in this and the grey rock below. On close inspection, the materials of this mass appear to have been subjected to much wearing action, and many specimens exhibited numerous fragments of bones, apparently belonging to fish, and similar to those found in the red sandstone on the Tioga.*

This rock, examined here and several miles south, is succeeded by a mass consisting of greenish grey sandstone, often appearing as if deposited from opposing currents, and in all respects resembling that succeeding the red sandstone on the Tioga. Should these facts be established, it will prove the thin red rock to be the continuation or equivalent of that great mass of the old red sandstone.

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*See page 393.

In examinations further south, I have not been able to discover the red sandstone, neither along the Allegany and its tributaries, and I am informed by Mr. Horsford that he saw nothing of it in his journey down that river as far as Warren, Pa. which brings us to the northern limits of the coal.

From the fact that this red sandstone does not appear to have been recognized as a thick mass east of the Tioga, it affords us some valuable facts regarding the manner of deposition in many of our rock masses, being in deep basins of greater or less extent, some rising rapidly from the centre, and causing the abrupt thinning out of the deposits; others, from their more gentle ascent, admitting the gradual thinning of the strata, and their continuance over a greater area. The condition of the ancient surface, together with the different sources of materials deposited, have caused many difficulties in identifying strata at distant points. The latter is a subject of great interest; for we can readily perceive that a mass of lime or sand-rock, although now spread over a great extent, must have had an origin elsewhere than at the point where we may chance to examine it; and we reasonably infer that the thicker portions of the mass are nearer the source of the material, from whence it flowed over the bottom of the ancient ocean in the state of soft mud, its direction being determined by a current, or otherwise, until it thinned out at a distance from its origin, in proportion to the quantity of material supplied.

Whenever it happened that sand and mud, or clay in a state of extreme comminution, were furnished from the same source, the sand would be first deposited, and the clay last; while particles of carbonate of lime might be intermediate. In the strata of western New-York, materials of the same nature appear to have come from different directions; thus we find the Lockport limestone thinning out in its eastern extension, and again the Tully limestone thickest at the east and growing thin towards the west.

The source of sand appears to have been at the east; for all the strata of the upper rocks grow more sandy in that direction, and more argillaceous in going west: either clay was furnished from the west, or more probably from its facility of transportation it was carried beyond the sand, its origin being the same. The Oriskany sandstone thins to a few inches as we proceed westward. The rock described in the present report as the Cashaqua shale, containing but a few concretionary masses of argillaceous sandstone, is on the eastern shore of Cayuga lake represented by a mass, the greater part of which is sandstone; also in Seneca county it is mostly sandstone.*

The changes in character of strata, and their probable sources, will be treated of more fully hereafter. Mr. Vanuxem has detected rocks of volcanic origin in the saliferous group at Syracuse; and Mr. Rafinesque some time since expressed an opinion that all the salt springs proceed from volcanic causes or from a "*salz*." It may be hereafter demonstrated that the thick mass of calcareous marls, &c. of the Onondaga saliferous group proceeded from a mud volcano, and were spread over the surface much in the same manner that chalk in Europe is supposed to have done. There are also many reasons for supposing the Lockport limestone to have had the same origin; or more probably to have been affected after deposition, by similar causes.

To return from this digression. The strata above the red rocks at Wellsville, those on the Shenunda creek and towards the Pennsylvania line, contain no fossils. The mass greatly resembles that above the red sandstone elsewhere; and the great elevation of the points examined, considered with the difference in altitude between this and the Tioga, may lead us to expect these rocks in place as far north.

Conglomerate.—Occasional fragments and boulders of this rock are found in the elevated lands of Steuben, and the eastern part of Allegany.

About three or four miles south of Wellsville, the side hill and valley east of the Genesee are strewed with masses of the same, consisting of small and large pebbles of white quartz with coarse sand. From the great numbers of fragments, we would infer the rock to be in place near; and in a former section this position was given to the conglomerate: though from careful investigation I am not able to find it in this vicinity, the position is undoubtedly correct; for it appears on the hills west of the Genesee, in Scio, and several other points. Its thickness, however, is not so great as, from its extending over so great a surface, I had heretofore supposed.

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* This mass holds the same position as the Sherburne Flagstones of the third district.

In Scio it is found on the high grounds near the sources of some small streams flowing into the Allegany and Genesee. For the most part the rock appears in large detached masses, being divided by the joints into rhombic blocks ; one of these measured 44 by 60 feet, and 15 feet in thickness. Approaching the rock in place the masses are larger and closer together, being but slightly moved out of place, and the spaces between them diminishing from a distance of five or six feet to fissures of a few inches. The sides of the blocks appear water-worn, or deeply weathered ; and the upper surfaces slope in the direction of the hill, probably from the removal of the rock beneath. The mass seems to have contracted on dessication, and the joints, since enlarged by the percolation of water from above, form within the rock passages of greater or less extent, communicating with each other. The peculiar features in other localities will hereafter be mentioned.

This mass is composed of pebbles of crystalline quartz, white or rose colored, from one to two inches in diameter, and generally elongated or egg-shaped. In the early settlement of the country this rock was used for mill stones ; but in much the greater part the pebbles are too large and it is too friable for this purpose ; its use is now superseded.*

Previous to visiting this place I was informed that a bed of coal two feet thick had been found beneath this conglomerate ; it was represented as having been used in the blacksmiths' forges. On further inquiry I could not learn that such a bed was known ; the only person who could give any information of its existence had seen small pieces not more than one-half inch in diameter.

This rock is the only one seen between Wellsville on the Genesee and Bolivar, a country which is entirely a wilderness.

In the town of Genesee, about three miles north of the Pa. line, and near the centre of that town, the conglomerate, essentially the same as at Scio, occurs on the highest hills.

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* The conglomerate is an excellent material for roads ; and if thrown down in moderately large pieces, would soon, from its friable nature, be broken down, forming a fine gravelly surface superior to the McAdam roads.

On the little Genesee, a few rods north of the Pa. line, sandstone and shale with fossils appear in place; this is at nearly the level of the stream, 200 or 300 feet below the conglomerate. I saw, also some detached masses, resembling the red rock at Wellsville, and a reddish soil which may be caused by the outcrop and disintegration of the same stratum. Along the southern line of the county the rocks are interrupted by the valley of the Oswaya creek; and thus we have no means of tracing their continuation or connexion with the formations of Pennsylvania.

The valleys being high, the elevation of the hills above them is less than in the northern part of the county; the slopes are less abrupt, and deep ravines fewer; consequently we have not the same facilities for examination. In this region of country the hills have been fashioned by the water-courses, ancient and modern; in primitive countries the position of the mountains has given direction to the streams.

At several places in the western part of this county, as at Cuba, we find rocks of shale and sandstone similar to those already described; and quarries are opened to some extent.* About 50 or 60 feet of rocks of shale and sandstone, some of the latter concretionary, are seen in the banks of a small stream at Bissell's quarry, a mile southeast of the village. The harder portions are used for cellars, &c. At another quarry south of the village, on the land of Ira Weaver, some of the sandstone has been used for grindstones; the rocks contain large numbers of Leptæna and Delthyris.

All the rocks in this vicinity are highly bituminous; and the last named quarry is not more than half a mile from the famed oil spring, which will be mentioned in another place.

West of the village of Cuba is another more extensive quarry on the land of Judge Chamberlayne; this affords sandstone in thicker masses, and better fitted for building than the others.

Between Cuba and Friendship rocks scarcely appear in place, though they are not far beneath the surface. In most of the high grounds of the southern counties the soil is shallow; the substratum being but a few feet beneath it.

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* Mr. Talcott, resident engineer, politely accompanied me to the principal quarries in this vicinity.

CATTARAUGUS.

The general surface of Cattaraugus county maintains about the same elevation as Allegany ; the Genesee in the former, and the Allegany river in the latter, also take their rise in about the same altitude, and continue their course with nearly the same descent, though flowing in nearly opposite directions. Although this county is crossed by numerous streams of considerable size, still there are few situations where a good view of the rocks can be obtained. The valley of Ischua creek, which extends nearly across the county from north to south on its eastern side, exposes the strata only in a few places. The Cattaraugus creek pursues its course the whole distance in the outcrop of the strata, consequently developing but one or two rocks.

The rocks of this county are a continuation of the same groups noticed in Allegany county. The Gardeau and Portage groups form the northern boundary of the county, and are exposed along the Cattaraugus creek. These are succeeded by the same shales and sandstones as before noticed in Allegany. There appears, however, a general diminution in thickness of all the masses to the westward ; and many which in Allegany are of great thickness, appear here much diminished. This must necessarily be the fact, since all the upper groups thin out partially or entirely before reaching the State of Ohio, where the lower limestones are brought into the immediate vicinity of of the coal measures. When the examinations in Chautauque county are completed, we shall be able to present some more correct data regarding the rate at which these rocks diminish in thickness going west.

Notwithstanding that the rocks are exposed at few places, still from the great elevation of the country and the thinness of alluvium, they are found at moderate depths below the surface. On the south branch of the Cattaraugus creek, there are several points where rocks are exposed, but there are no deep excavations. In the southwest part of Freedom, on lot No. 19, there are several courses of sandstone and shale, exposed in a deep ravine, along which the road winds. Some of the sandstone courses are two or three feet thick, others but a few inches. It is quarried for grindstones, being of the same quality as the Rushford grindstone rock, and in fact is a continuation of the same mass. The strata above the grindstrone rock, are characterized by the peculiar fucoid so abundant in the same rocks on the Caneadea. In some of the sandstone courses there are numerous small nodules of shale, which render the rock unfit for grindstones. The quarry has not been opened to any considerable extent, but is favorably situated for working, being on a triangular point of a hill, at the junction of the ravine with the valley of the creek.

In the southeast part of Machias, on lots No. 3, 11, and 19, there is an extensive outcropping of a thick mass of sandstone; it extends along the northern escarpment of a hill for more than half a mile. The whole thickness of the mass could not be readily ascertained, but it is probably ten or fifteen feet, and in layers from one to four feet thick. This mass from being more indestructible than the shale above and below, has been left projecting beyond it, and has broken down in large masses for several rods in width along its line of outcrop, presenting an appearance like that on a lake or sea shore when a rock is undermined and falls down. These fragments are from two to thirty or forty feet square, and split readily in any direction. The stone is coarse grained and rather friable, though it may be considered durable from remaining of such dimensions, though so long exposed to the weather. The dressed stone is delivered at the quarry at one shilling per foot, and the same at Ellicottville, sixteen miles distant, at four shillings per foot. I have seen no place in the southern counties where stone can be wrought with equal facility, or obtained of such dimensions. A few fragments of Delthyris are the only fossils found in this rock. This point is about sixteeen miles from the canal at Hinsdale. The stone is wrought principally at two quarries, one belonging to Mr. Butler, the other to Mr. Jewel.

About one mile and a half west of Hinsdale village, on the road to Ellicottville, in the bank of a small stream, there are some thin layers of compact sandstone, and also micaceous and shaly sandstone of an olive colour. Leptæna and Delthyris are abundant in the rock at this place. Farther north, the same strata become concretionary. The Ischua creek, one mile and a half above Hinsdale is crossed by rock, which causes a fall in the stream. Three miles north of Olean point, the rocks are exposed on the east side of the valley near the top of a hill; a soft sandstone and sandy shale constitute the principal part of the mass. At several other places between Hinsdale and Olean, quarries might be opened with little labor.

The channel of the Cattaraugus creek exposes the rocks of the Cashaqua and Gardeau groups, throughout the greater part of its course in this county. Being a valley or water-course of recent excavation, its sides exhibit perpendicular cliffs, often rising to the height of more than two hundred feet. The stream often flows over a rocky bottom, showing that it has never been a deeper valley.

Conglomerate. The conglomerate already described as occurring in Allegany county, is found in several places in Cattaraugus county. One of these localities is south of Olean. After crossing the Allegany and proceeding through the woods about three miles in a southerly direction, we observe the first indications of the conglomerate. The elevation of this place cannot be less than five hundred feet above the Allegany river. It occurs in masses of small size, which increase in number and dimensions as we approach the rock in place, which is probably thirty or forty feet thick. Coarse gray sandstone is interstratified with the conglomerate. The pebbles consist of crystalline quartz frequently an inch or two in diameter, externally white, but often rose-coloured within. The materials are probably of northern origin, and were transported to their present situation by a more rapid current than we have any evidence of in the lower rocks. This change in the character of the rocks is an interesting one, more particularly from having taken place previous to the deposition of the coal strata, and was probably a change dependent upon circumstances producing those deposits.

Approaching the rock in place, the fragments lie apparently scattered irregularly over the surface, but on drawing near to the ledge, we find them nearer together, and arranged in a kind of order. This order or arrangement proceeds from the direction of the joints; and these immense blocks are separated first a few inches, then one, two, three feet, &c. and finally they become so far separated that the direction of the joints cannot be traced. This arrangement of the huge blocks has caused the fanciful name of ruined city to be applied to the place, and it requires but little aid of fancy to convert these broad fissures into streets and aisles, and the huge masses on either side into dilapitated buildings. Sometimes a fragment above has slipped and covered two lower ones, or the soil above conceals the joint. Then we have subterranean passages and courts, now the abode of bears and wolves, where in a few moments we may exchange the light of day for mucky darkness, occasionally broken by a glimmer through the rock fissures or broken soil of the roofing.

The fact, that the coal of Blossburgh, Warren, and some other places in Pennsylvania is overlaid by a conglomerate, has excited expectations of finding that mineral in Cattaraugus Co. The supposed place of the coal is beneath the conglomerate, and the reason alleged, it not being seen in the outcrop is, that the rocks deposited previous to the coal dip south at a greater angle than the coal beds, that the conglomerate resting upon the latter has its northern edge projected beyond the coal and resting on the rocks beneath. Were this supposition the fact, we should still expect to find the coal in the escarpments on the east and west sides of the hills, and it will be recollected that the conglomerate occupies only the summits of the highest hills, and is not continuous in an east and west direction or line of bearing. Under these circumstances, and knowing nothing more of the rocks and their association, it would be unwise to undertake boring through the conglomerate in search of coal.

So far as our examinations have yet progressed, I see no reason to suppose the carboniferous strata beneath the conglomerate. On the contrary, we believe this rock to be below all the workable coal beds at least, and this opinion is founded on the lithological and fossil characters of the rocks below it. Thus far, I have not been able to trace the immediate connexion of this rock with those beneath, but there cannot be more than one hundred feet intervening between it and the rocks examined.*

As this subject had become one of considerable interest to several gentlemen in Cattaraugus Co. I was anxious to obtain all the information in my power; and knowing the formation in question to be more extensive in Pennsylvania, I addressed a letter to Prof. Rogers on the subject. His views fully confirm what has been stated, that no coal can be expected beneath this conglomerate. He considers the conglomerate above the coal as an entirely distinct rock from the one of which we have been speaking.

During the next season, I hope to be able to show the exact connexion of this rock with the fossiliferous groups of New-York, and also its relation to the coal measures of Pennsylvania. For the present it can only be regarded as of limited extent, and extremely variable thickness, and although in one place a well defined mass, it may be in another very inconsiderable. We may perhaps hereafter, be able to identify this rock as the equivalent of the millstone grit of England, which lies beneath all the coal measures. So far as I have been able to trace its connexion with rocks above and below, it holds the same place in the series. This view of the matter will sufficiently account to those interested, why I am unwilling to recommend any expenditure in boring or other explorations in this rock or beneath it.

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* Mr. Vanuxem in his report of 1836, has described the position of this and other masses of conglomerate.

The rules of science are as immutable as the laws of creation, and so long as we profess to be guided by science, we must submit to its requirements. Because, as in this instance a rock, possessing certain lithological characters, is observed, we are not to infer from that alone, that the rock may contain the same minerals as another of like character, without taking into consideration the difference of position or associations.*

LIVINGSTON COUNTY.

The county of Livingston exhibits principally a continuation of the same rocks as are found in Ontario county, and described in the report of last year. Beginning on the north these rocks are the Hydraulic limestone, Onondaga and Seneca limestones, the extensive group of fossiliferous shales succeeded by the upper black shale; the Cashaqua shale, the Gardeau and Portage groups. The latter occupies only some of the high grounds in the southern part of the county.

The most prominent feature in this county is the great valley of the Genesee river, which passes nearly through the centre of the county from north to south. This valley in connexion with others, will be described at the end of the report.

Hydraulic limestone.—The northern part of Caledonia presents a view of the hydraulic limestone, which is quarried in several places within the town, and also at a little distance north, along the northern slope of the terrace. This rock underlies the village of Caledonia, and from this place its northern limit is southeasterly to the Genesee river. The oblique direction of the outcrop of this and the succeeding rocks on either side of the Genesee is owing to the denuding action, formerly in operation along this great water course, which removing the superincumbent masses, exposes those below farther south and at a lower level. This causes the line of outcrop to bend to the southward on either side of the valley as we approach the river, and after crossing, it again turns to the north, till it comes in a line with the general east and west strike of the rocks.

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* For a continuation of the report on Cattaraugus county see Appendix, Mr. Horsford's report.

The hydraulic limestone has been burned at Caledonia and used in some works near this place, but it was found to possess too little cohesive power, and did not sustain the structures. This is the only trial that I am aware having been made of the cement from this place. I see no sufficient reason why some parts of it may not make as good cement as the same rock in other places. Were it the proper place to introduce the subject, much might be said on the causes of failure in preparing and using the lime made from this rock at various places.—In the first place the component parts of the rock should be known, the character and proportion of sand depending on the composition of the lime, and the variable composition of the sand rendering different proportions necessary for the same lime. The composition of sands necessarily varying at different localities, has often more influence on the compound than the lime itself. The mode of preparing, quantity of water &c. used in preparation, all have an influence, and an important one.

For a distance of two or three miles southeast of the village of Caledonia, thin flat masses of the drab limestone are scattered over the surface, in many places in sufficient quantities for enclosures ; its out-cropping edges often approach so near the surface as to be turned up by the plough. Three and a half miles southeast of Caledonia the drab limestone is quarried in large quantities for use on the Genesee Valley canal. The quarry is owned by Mr. Wadsworth of Geneseo. There are about twenty feet in thickness of the rock exposed ; the lower part is in thin layers of a bluish color, striped with lighter bands. The succeeding courses are from two to two and a half feet thick, of a drab color striped with darker; it is easily quarried, splitting into masses of any dimensions, and becomes very hard and brittle on exposure. The upper seven feet of the mass is often in one course, though generally divided into two ; this portion, and a course of two feet below, contain numerous irregular cavities, often filled with greenish clay, gypsum, sulphate of strontian, blende &c. In some of these cavities there are remains of some coralline fossils, the greater part having been dissolved out, probably by the action of sulphuric acid, which formed with the lime gypsum and with strontian its sulphate.

The same causes which here produced the small nodules of gypsum, were in operation over a large extent, to form the immense quantity which occupies a place in the rocks beneath the drab limesone. Owing to this circumstance only, we find no fossils in the gypseous rocks, for none could exist in a sea where sulphuric acid was a free ingredient.

The continuation of the drab limestone on the east side of the river is found in Rush and Mendon, and has already been noticed in the survey of Monroe county.

Onondaga limestone.—The Onondaga limestone succeeds the last described rock ; it scarcely extends into the town of Lima, but it forms the substratum of the northern portion of Avon, and in the river valley extends as far south as the centre of the town. This rock is quarried in the Conesus Lake outlet, and on a small stream a short distance further east ; at these places only a few feet of the upper part of the mass is seen. It is easily quarried in blocks of large dimensions, and is nearly free from hornstone. The stone is wrought for use on the Genesee Valley canal. The fossils at this place consist chiefly of Strophomena rugosa, Atrypa affinis, Delthyris, and some fragments of Trilobites. The greater portion of this rock on the east side of the river is covered by a deep alluvium which renders it difficult to trace its bearing and outcrop with extreme accuracy.

On the west side of the river, this rock first makes its appearance in the southeast conner of Caledonia, near the town line. At this place a very extensive quarry has been opened, on the west bank of a small stream, on land of Mr. Christie. From this place large quantities of stone have been taken for the construction of locks, aqueducts &c. for which purpose no better stone can be found. It is entirely free from seams, and is easily quarried and dressed. The whole thickness exposed does not exceed ten feet ; the courses varying from one to two and a half feet. None of the layers are continuous of the same thickness, sometimes a thick one thins out entirely and its place is taken by two thin ones, or a thin layer in one place becomes a thick one at a few rods distance. Sometimes the courses are separated by a thin irregular course of hornstone, at others this hornstone is in the centre or near the surface of a layer of limestone. The presence of hornstone in the limestone injures the mass for working, and no blocks are dressed which contain large nodules of hornstone. In some parts of the quarry, fossils are abundant, while in other parts very few are found ; individuals of the Cyathophylli are often found of very large size.

The price of the stone lying in the quarry is fifty cents per cubic yard. Several thousand dollars worth of stone have been taken from this quarry within the two past years.

From Christie's quarry the limestone pursues a northwesterly direction; passing just to the south of Caledonia village, it crosses the road a little west of that place, and pursues the same direction to the top of the terrace on the south side of Allen's creek. West and northwest of Caledonia, large numbers of fossils are found in this rock; these consist of Cyathophyllites, Favosites, and other corallines with Strophomena, Orthis, Delthyris, &c. In this part of the town the lowest portion of the rock is thick bedded and compact; above this it contains a large proportion of hornstone, and in some places is composed almost entirely of that substance. Being in irregular shaped masses and surrounded by limestone, which decomposes on exposure, it is left scattered over the surface in rough and shapeless forms. These fragments are crossed in every direction by innumerable fissures which are expanded by freezing water, and the whole falls into small fragments, which in many places literally cover the surface for many acres. Where the road crosses this part of the rock it has the appearance of being made in a bed of flints.

From the jagged and irregular appearance of the hornstone rock as it occurs in detached masses, it has received the familiar and expressive name of "*chawed rock*." This rock is the best material for road-making which western New-York affords. Where it approaches the surface the soil is rather barren, producing only a growth of dwarf oaks, but when there is a tolerable proportion of finer materials it produces a fertile soil. A large proportion of the native growth along this terrace consists of oaks.

In several places along this range of limestone there are appearances indicating uplifts in the strata, but the greater part if not all of these are fallacious, and caused merely by some of the strata being undermined and afterwards having fallen down of their own weight. These points present a ridge of the rock dipping in two directions, but in all those which I have examined, the dip to the north is abrupt and the rock terminates within a short distance. In some places there are downheaves of small extent, which have been caused by the solution and removal of the mass below, leaving that above to sink down. Notwithstanding this fact however, sink holes are of rare occurrence, through-the limestone region, and none of them of the character of those in Albany and Schoharie counties where the rock contains a greater thickness.

Marcellus Shales.—The Onondaga limestone is succeeded by the "Marcellus shales," the Seneca limestone being absent. These shales possess their usual essential characters, the middle portions quite compact and highly bituminous, becoming more slaty above and below.—The compact part of the shale usually contains large septaria; these sometimes consist of large silico-argillaceous masses without seams of crystalline matter. This rock follows the same course as the limestone, commencing on the east near the north line of the county, it passes southwest to the Genesee river; thence its course is northwest though the town of Caledonia, passing into Genesee county near the north line of this town.

On the Conesus outlet near the lower saw-mill at Avon, this shale may be seen resting on the limestone. About thirty-five feet from the bottom of the shale there is a stratum of limestone one foot thick, sometimes concretionary, and containing Orthocera, fragments of trilobites &c. For several feet below this, the rock is black, slaty and very fragile. A few feet of the shale above this limestone is black and slaty; it abounds in fossils of Orthocera, Orthis, Leptaena, Pterinea and a very small species of Orbicula. Above this the mass graduates into a greyish or bluish grey slaty shale, and contains few fossils.

This shale is seen in the ravines and hill-sides, on the west side of the Genesee, extending through the northeast corner of York, and thence through the southwest part of Caledonia. Mr. Hallenbeck of Mumford accompanied me to a place in the south part of this town, where a digging for coal had been made in the black shale. The indications which induced digging at this place were the black and highly bituminous character of the shale, thin seams of coaly matter and petroleum. I did not learn to what depth the excavation extended, but presume it to have been less than forty feet, for at that depth the Onondaga limestone would have been reached. The excavations were made at two places, one on each side of a small shallow valley which was originally worn in this shale. North of the valley, on the farm of Mr. McLean the same shale was penetrated in digging a well. Some portions of the rock are so highly charged with bitumen as to burn when thrown into a hot fire. In these shales as well as in the upper black shale, numerous excavations for coal have been made, and in each one alike fruitless.

It is unnecessary to give a detailed description of all the shales succeeding the last, as their lithological characters are nearly similar till we come to the upper black shale. Those shales heretofore described under several different names, and all containing their peculiar and characteristic fossils may be found along the outlet of Conesus lake in the ravines btween that and Geneseo ; on Jacock's run and another small brook farther south.

At one place near Wadsworth's mills on the farm of Mr. Moore, the Moscow shale was excavated in large quantities and ground, in the belief that it was gypsum. This delusion however lasted but for a year or two, and it is now abandoned. Containing much calcareous matter it is a good material for enriching sandy soils ; and there are many places where the decaying cliffs of this shale have produced, with the creek alluvium a very fertile soil. The shale, alone, on decomposing forms a clayey soil and packs too much on drying.

On Jacock's run the Ludlowville and Moscow shales can both be seen, separated by the thin mass of crinoidal limestone. Here as elsewhere in the district, the Moscow shale is known by its fossils, the Calymene and Cryphæus, while the Ludlowville shale contains Atrypa concentrica, and large numbers of Cyathophylli and other corallines. These fossils are very characteristic of the two shales, still in some localities the Cyathophylli and smaller corallines occur in the Moscow shales, but are not characteristic of this mass.

At York the Ludlowville shale is exposed on a small stream near the village ; the fossils are chiefly Cyathophyllites and Favosites, both in great perfection and beauty ; among the former there is a specimen placed in the State collection, consisting of twenty-six individuals of the species turbinatum, all closely grouped together. The shale is succeeded at this place by the Crinoidal limestone which contains, besides great numbers of encrinal columns a species of Avicula, resembling the A. reticulata of Murchison. This shell is a very constant fossil of the crinoidal limestone, and may be found in most localities. In the same ravine, several hundred feet lower, may be seen the hard calcareous shale, or shaley limestone, mentioned in the report of 1839, as occurring at Tyler's on Seneca Lake and at Orleans in Ontario county. At several other localities these shales may be seen, but being of little economical importance, no more will be said of them at present.

At Moscow the locality which gives name to the upper member of this group of fossiliferous shales we have them exposed, containing the characteristic fossils in great perfection. These are the Calymene bufo, Cryphæus calliteles, Atripa affinis, A. prisca, and two or three species of Delthyris. The principal locality is in the beds and banks of Beard's creek, on the land of Jerediah Horsford Esq. More than fifty species of fossils have been found at this place.

The Moscow shale is also exposed in a ravine and the bed of a small stream near the residence of the Hon. G. W. Patterson. These localities are in a deep valley of denudation and much below the general elevation of the surrounding country, the surface of which is occupied by the upper black shale.

Upper Black Shale.—In the ravines both east and west of Moscow we find the Upper black shale, also in a hill crossed in going from Moscow to the new bridge across the Genesee, and in the hill side ascending from the valley to Geneseo. The same shale is seen in Fall brook where the water leaps a hundred feet from the top of this rock. It underlies the village of Geneseo; it is seen in many places on the road east from that place, and in the ravines between them and Conesus lake. In this neighborhood the black shale is succeeded by a thin stratum of impure limestone, which has been burned for lime at one place near Moscow.

At the bridge crossing the Genesee near Mount Morris the black shale is exposed, possessing all its essential characters—being bituminous, containing thin seams of coal, great numbers of septaria, sometimes irregularly scattered, at other times in regular courses.

The arrangement and distribution of these septaria depended upon the supply of material; and the tendency to concretionary forms proceeded from the amount of material being too small for a continuous stratum, which together with the homogeneous state of the particles caused them to take this form. Sometimes we see a single insulated mass and no others in the same parallel of stratification; at other times we find them distant from each other but in the same plane of stratification. Again we may find a course of them in the same plane and each of them separated only a few feet from the other. Still again when the supply was greater we find a continuous stratum or bed, as in the case on Seneca Lake, where the regular course of septaria in the upper part of the black shale becomes, from increase of material, a continuous stratum three or four feet in thickness. This change is seen in many cases near the thinning out of a mass; the supply of matter diminishing till it is traced only by distant nodules or concretions.*

Near Geneseo, Moscow and Mount Morris the black shale is characterized by the presence of great numbers of Posidonia, which is almost the only fossil it contains. Two species of Lingula, an Orbicula, and an Orthis are characteristic of this shale in other places.

In several places this rock is traced for several miles from its northern outcrop on the hills, to its final disappearance south in the bottom of the valleys. This is owing to the circumstance that the valleys are excavated in the direction of the dip of the rock. Its final disappearance is in the bed of the Genesee, two miles south of the Mount Morris bridge.

Cashaqua shale.—A hundred feet of this rock is exhibited at the gorge at Mt. Morris, limited below by the black shale just described, and above by the Gardeau group. It also appears in many ravines in the south and southwest part of Leicester; in the vicinity of Mount Morris, in the Cashaqua creek, whence it takes its name; in the ravines on the east of the valley, and at a higher elevation southeast from Geneseo and approaching nearly to the village.

The Gardeau and Portage groups already described are the southern rocks of the county. These are seen in the deep gorge of the Genesee, and in almost all the ravines and water courses of the southern towns. Among numerous localities as we approach Dansville may be mentioned, Stony brook in Sparta where several hundred feet of these rocks are exposed. The shale in the upper part of this ravine has been ground and used as plaster. Several years since, this gorge was swept by a freshet which covered many acres of land in the valley, and changed the course of the stream.

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* Those masses which are properly termed septaria, consist chiefly of compact carbonate of lime, aggregated in a spherical form, and divided in various directions by seams of crystalline matter, carbonate of lime, sulphate of baryta, &c. The masses often inclose cavities containing other crystalline substances, and also petroleum. Again other masses and often part of the same course are not crossed by seams; but are nevertheless the result of the same laws, differing only in this, that after aggregation, no part was separated by crystallization.

There are several quarries between this place and Dansville in which it is difficult to find any characteristic fossils. The rocks consist of thick layers of sandstone with intervening masses of shale ; and near Dansville give more marked evidence of the group to which they belong. Quarries have been opened on both sides of the valley, where materials are now obtained for locks, bridges &c. on the Genesee Valley canal. The group also affords the finest flagging stones in the district ; these are known by the presence of the fucoids already mentioned.

GENESEE COUNTY.

In this county we find the rocks of Livingston, with the addition of the Onondaga saliferous group on the north, which extends through the towns of Bergen, Byron, Elba and Alabama, and into the northern parts of Leroy and Stafford.

The most northern portions of this mass consist of greyish or greenish grey marl, homogeneous in texture, and very compact when first exposed, but crumbling rapidly. Thin courses of reddish and chocolate colored marl are seen in some places in the northern part of the county. Farther south and along the centre of these towns it is more grey or ash colored, contains thin seams of fibrous gypsum and selenite, and occasionally small masses of granular gypsum. This part of the mass is exposed only in wells which from the difficulty in obtaining water, are often dug to the depth of 70 or 80 feet. The grey marl and gypsum is found to contain large seams or joints apparently water worn ; these without doubt act as drains and carry off the water from above.

Some wells in this part of the group yield an acid water. One of these, belonging to Mr. Gifford, of Bergen, I examined in company with the Rev. Mr. Griswold* ; the water is said to contain acid enough to curdle milk ; and though not sensible to the taste is considered unfit for use. The famed acid spring in Bergen rises from this rock. Some of the wells in the immediate vicinity, and in the same formation, yield good water.

A little north of Bergen Centre the greenish marl comes to the surface, and is excavated for the passage of the rail-road. Two miles west of that place the same marl is seen in the roads and in the banks of the small streams ; and approaches the surface over the greater part of this neighbourhood.

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* I am particularly indebted to the hospitality and attention of this gentleman, who has given much attention to the Geology of the vicinity.

The grey or ash colored marls just described, are succeeded by bluish, slaty and drab colored impure limestone, which embrace large beds of gypsum. These occur mostly in the north part of Leroy and Stafford. Gypsum is also found in the western part of Elba, near the junction of the Pine-hill road, with the Batavia and Lockport turnpike ; which is the most northern point that I have found it, in the county. At this place some 30 or 40 tons were quarried ; but the masses being small, and about eight feet below the surface, requiring the removal of all the superincumbent earth and stone; the work proved unprofitable and was abandoned. That which was quarried still lies on the ground.

In the vicinity of this quarry, and for some distance west, there are sufficient indications of gypsum in the peculiar irregularity of the surface ; being raised into little mounds, which give the appearance of heaps of earth deposited on the level soil. The thin bluish or drab limestone, is also found near the surface, and often ploughed up in the fields.

In the north part of Leroy plaster is obtained in large quantities, on lots 118, 144 and 132. The quarries in the first are of white gypsum, and free from seams and intermixture of clay ; it is covered with a bluish kind of limestone with shaly seams, and splitting into laminæ ¼ or ½ an inch thick. In the others, the gypsum is clay colored with seams of clay ; this when exposed crumbles rapidly ; the rock above is a drab limestone, resembling in general appearance the hydraulic limestone. In this I fonnd some few fossil shells of a species of Pterinea. Some parts of the rock are filled with small round pores the size of a mustard seed ; such are also seen in the soft limestone, a few feet below the hydraulic or drab limestone.

The masses are all more or less spherical ; the surrounding rocks being raised in the centre, presenting a fractured convex surface, dipping on every side of the mass.

The quarries last mentioned, belong to Messrs. Bannister, Collins and Clifford ; the white gypsum to Mr. Hughes and Mr. Cash. The plaster is sold at the bed for fifty cents per ton; when ground, from $3.00

to $3.50 per ton. The different beds in this county, furnish about 3,000 tons annually.*

The formation described, belongs apparantly to the second or middle series of gypsum beds; the upper, like that at Seneca falls and Vienna,† is not seen, neither have I been able to find the lower series; but although similar, in general character it would appear that the white gypsum above described, which is half a mile north from the others, must be at a different elevation, as well from its position, as from its associated rocks. The general direction of the masses is N. W. and S. E.; as appears both from the beds, and from their re-appearance in the western part of Elba.

The alluvial excavation along the valley of Black and Bigelow creeks, has either removed the gypsum or covered it so deeply with alluvium, that it is not reached in ordinary excavations; but unless so removed, the whole distance across the country is probably underlaid by it, though its depth may be too great for profitable exploration.

The gypsum is succeded by various colored marls, mostly bluish, greenish and drab or ash colored; some hard and very calcareous; others, soft, crumbling, and forming a tenacious clay.

Hydraulic limestone.—The drab limestone, hydraulic limestone, is the next succeeding mass. The essential characters of this rock have already been described; its thickness is variable, and also the proportion of sand, clay and carbonate of lime. Its connexion with the Onondaga limestone above, is seen to advantage, at the falls on Allen's creek, two miles north of Leroy, and also at Morgansville, where the Black creek descends from the limestone terrace to the level of the country north. At this place the following section is exposed.

	Feet.	Inches.
7. Onondaga limestone, in several courses,	3	
6. Oriskany sandstone,	0	4
5. Hydraulic limestone in thin courses,	4	
Carried forward,		

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* Mr. Hughes informs me, that the plaster dug from one acre, yielded a nett profit of $2,000, and the land is in as good condition for cultivation as before.

† See Geological Report of 1839, pp. 291 and 305.

	Feet.	Inches.
Brought forward,		
4. The same, mostly in thick layers, one being six or eight feet thick, highly silicious, with irregular cavities,	22	6
3. The same, in thin, greyish layers, with seams of blue marl,	12	
2. Bluish marl, crumbling into irregular angular fragments,	5	
1. Greyish and greenish marl, with some portions very compact, ten or twelve feet of the lower part filled with small cavities or pores, like those in the rock covering the gypsum,	19	
	65	10

The drab limestone is not so thick at this place as at some others which I have examined.

This rock forms the northern escarpment of the great limestone terrace, extending from the Genesee to Lake Erie, and also seen in the counties east. It passes through the towns of Leroy, Stafford, Batavia, and the south part of Alabama, forming the lower falls on the Indian reservation. I am not aware that it has been used for cement in this county, though it is doubtless good for this purpose.

Onondaga limestone.—This rock occupies the summit of the terrace ; extending from Livingston county westward, it passes, with variable width, to the north of the village of Leroy, underlies Stafford, Morganville, &c. the north part of Batavia and Pembroke. A few feet of the lower portion of this rock is in regular courses, with little or no hornstone ; the succeeding 40 or 50 feet consists principally of hornstone, being a rough, ragged mass, called the "*chawed rock.*" This, in some places, contains large numbers of coralline fossils.

From Leroy village to the falls, a section of rocks shows the black shale, Onondaga limestone, (the Seneca being absent,) the hydraulic limestone and the marls below ; there is scarcely a point in this distance where the rocks are concealed. The whole thickness, including the "*chawed rock,*" is less than 100 feet. Along this stream are fine opportunities for quarrying, though little improved.

About two and a half miles north of the village of Leroy, and west of the creek, there is an extensive quarry, in the Onondaga limestone, belonging to Mr. Rich. The rock at this place appears in courses, varying from six inches to two feet; it is almost wholly composed of fragments of encrini and other fossils, crystalline in texture, yet quite tough: the thick courses are often divided by seams; these, when of clay, cause the blocks to separate, at other times produce no injury. From the quarry, the rock is taken to a mill a mile south of the village, and sawn into slabs and blocks; it is afterwards polished and used for fire places, mantlepieces, &c. The polished stone has often a very beautiful appearance, and is highly prized by the collector, on account of displaying the internal structure of fossils cut through in the process. The crinoidal joints are often of a different color from the surrounding mass, a variety which increases the beauty of the stone. The polished slabs are sold from $1.00 to $1.50 per surface foot; the price varying with the labor bestowed. About $2,000 worth of the sawn stone is sold annually, besides several hundred dollars worth of the cut and rough stone of the quarry. Half a mile west of this quarry is another, from which, at the time I visited it, $800 worth of stone had been sold since the commencement of working it in the spring.

The dip of the rock at Rich's quarry, is southeast about 10°. This is probably owing to local causes, as the removal of the rock beneath by the action of water.

There are numerous places where quarries can be opened, when the demand for this kind of stone shall be sufficient; these will all hereafter, be a source of wealth to the owners of the soil, though it may be absurd to estimate their prospective value.

Lime is burned at many points along this range, supplying the immediate neighborhood, and also the country north and south. A great proportion of lime used on the Genesee Valley canal, will necessarily be obtained from this range of rock, there being no source of lime south except the marl beds. In Stafford, Batavia and Pembroke, this rock appears in very numerous localities. Two and a half miles from Batavia village, and half a mile from the north line of the town, a mass is exposed, being the hydraulic limestone, with some thin layers above, and the greater part consisting of the "*chawed rock*." This latter is most annoying to the cultivator, and when it overspreads the surface in large masses, almost totally forbids cultivation. This is seen in several places of small extent, in the south part of Alabama. The growth of timber on such land, consists chiefly of oak.

On the Indian reservation, this rock appears at the upper falls, and in the stream below; also between this and Pembroke. The thickness of the mass is very variable, as is seen in the quarries, where thick masses at one place may be merely recognized; in another, by layers of a few inches. West of Batavia, the terrace is not so well defined, though there is little difficulty in tracing the course of the limestone.

The shales above the limestone are seen to less advantage in the county of Genesee than in any other of the same range. At Leroy, the Black shale or Marcellus shale, succeeds the limestone, and is well exposed in the bed of the stream at that village. It contains large masses of Septaria, which are more calcareous than those of this shale in most places. The compact portions of the shale have been quarried for fire stones, and the Black stone store is built of the same material. I here found a fossil, the only one I have ever seen in the compact part of the shale; it resembles the scale of a fish.

The upper part of this mass exhibits the one foot stratum of limestone,* with its contained and accompanying fossils. Farther south, we find the other members of this series, at Clifford's mill, at Roanoak, and a little north, where it consists of those portions that are nearly destitute of fossils, and consequently of less interest. In the Four mile creek near Roanoak, the same shale is seen.

The Ludlowville shale, is found in two or three places in the town of Covington; one a mile north of Pavilion, another a mile and a half southwest, in the bank of the creek near Sprague's mill. The Strophomena carinata, is almost the only fossil I saw at the first place; at the latter, are Orthis, Delthyris, Leptæna, &c. The rock in place, is scarcely visible at either of these localities; at the first, it appears as a bank of clay, produced by the decomposition of the mass, leaving the fossils. This clay is used for bricks. At the latter, the decomposing edges of the strata are covered with gravel, &c. the fossils being washed out by rains.

At one or two places near Bethany Centre, the upper shales of this series are seen; and near the village of Darien on the Eleven mile creek, there is a natural section showing the Ludlowville shale, the Crinoidal limestone, the Moscow shale, and near the same place the upper black shale. The Ludlowville contains its usual fossils, Favosites, Cyathophylli, &c. the Atrypa concentrica, and A. affinis, Delthyris and Leptæna. The crinoidal limestone has fewer fossils than usual, but the Avicula reticulata? is numerous. The Moscow shale appears much thinner than elsewhere, and exhibits fewer fossils. The black shale contains Posidonia. There are other localities of less importance on the same stream.

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* See page 420.

The next range of towns south, as well as a great portion of Sheldon, Orangeville, Warsaw and Perry, are occupied by the Cashaqua shale and the Gardeau rocks. The southern towns, with the more elevated portions of the range next north, are underlaid by the Portage rocks; and in Arcade we find the commencement of the Chemung group, grits, &c.

In passing south, through the towns of Darien, Bennington, Sheldon, &c. we find that the rocks, mostly shale, lie near the surface almost continuously, except in the valleys. Ploughing often turns up the black shale, or the green Cashaqua, and the road sides expose the same at frequent intervals. These shales are left in little eminences above the general level of the country, and being covered with alluvium, are often mistaken for alluvial hills; whereas, the soil is thin, and the removal of a few inches frequently exposes the rock. These knolls are seen along the road south, from Long's Corners through Darien to Bennington. This condition of the surface, previous to the deposition of the alluvium, appears to have resulted from the action of the waters of a lake or ocean, where numerous currents and counter currents might wear away the intervening masses, leaving the projection of the little mounds of shale as we now see them.

In several places slight "*diggings*" have been made, upon the indications of some thin seams of coal. Three miles south of Wyoming or Middlebury there have been excavations at two points, and at one of these a boring of 30 feet. At the time I examined the place, the owners, Messrs. Marvin and Joseph Everest, were about contracting for a deep boring, in the sanguine expectation of finding coal. The first inducement to this undertaking was an observation from an Englishman; that the water resembled that from coal mines: (having a bituminous odor;) and some other person observed that the shale resembled that of the coal mines of Pa. To one unacquainted with the coal shale, this may appear sufficiently like it, yet it has none of the essential characters except color; and black shale exists in all the formations of New-York. Neither is the bituminous character of the rocks an indication of coal; for all the rocks of western New-York, even the limestone and sandstone, are bituminous.

The black shale at this place belongs to the Gardeau group; and had the boring proceeded, alternations of green and black shale, with thin layers of sandstone would have continued to the Cashaqua shale, which is seen at the ravine in Wyoming; and below this the upper black shale, &c. It cannot be too often repeated that it is in vain to seek for coal in rocks so situated.

In the ravine west of Warsaw some of the Gardeau rocks are exposed. In the ravine southwest of the village are found rocks of the Portage group, though mostly destitute of the characteristic fucoid. In this ravine there is a waterfall of 110 feet; which, together with the rocks above and below, gives a thickness of 200 feet at this place; they are principally shale with thin layers of sandstone.

The upper mass of this group may be seen at the falls on Allen's creek, near the north line of Gainesville and about three miles south of Warsaw village. On elevated ground fiom Sheldon to Warsaw, this mass with its vertical fucoid appears in several places along the road.

The county of Genesee appears to have been less affected by deep and violent currents than most others of the same range; and consequently the rocks are exposed at fewer points.

Physical Geography.—Valleys, &c.—The physical geography of western New-York, and indeed of the whole State, is a subject of much interest, but one to which, thus far, little attention has been given. One great difficulty has arisen from the want of knowledge of the elevations in different parts of the State. Of many places which have been surveyed, we have no published accounts, and of others no exact knowledge has been obtained. The published reports do not always give the information sought with regard to particular points. The surveys for rail-roads and canals, passing through the lowest valleys, do not give the elevation of the higher points, and we are still left with only an approximate knowledge of the subject for which we are seeking.*

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* The tables of elevations published by Professor Henry, in the 1st volume of the Transactions of the Albany Institute, are of great interest and importance.

The absence of all strata superior to the coal series, (if we except some small tracts of Tertiary towards the eastern part of the State,) in New-York and Pennsylvania, prove that this great area has never been submerged beneath the ocean for any length of time, since the period of these ancient depositions. We have proof, however, of the violent action of water in the denuding and excavating agency, in the production of valleys and water courses. These phenomena may have been caused in part by a sudden submergence, and the rapid passage of a wave over the surface. The subsequent changes may have resulted from an inland sea, which for a long period remained in possession of a large portion of the interior of the continent, ranging at various elevations. This, in its subsidence, gave rise to small lakes, on the more elevated grounds, which, from accumulating waters, burst their barriers and communicated with those of a lower level or passed off through the present water courses to the ocean.

The theory of an inland sea was advanced many years since ; but if we may judge from the manner in which the subject has been treated, it was considered visionary, at least. My attention was called to this subject by Mr. Roy, civil engineer, of Toronto, U. C. who has made many important observations regarding the former elevations of this sea or lake. These observations, which have been carried on by levelling, at different and distant places, sustain the opinion that this lake was stationary at different periods at certain elevations, where well defined margins are still observable. Such points have been observed in New-York, and we need only to refer to one at present ; that is the ridge road or lake ridge, extending from Sodus to the Niagara river.

These margins or shores of the ancient inland sea, are at the following elevations above tide-water, as marked on a plan or section constructed by Mr. Roy. At some of these margins, it remained stationary for a long period, at others for a short time only, depending probably on the facility with which the barrier at the great outlet was reduced.

Feet above the level of the Lake inland.	Feet above the level of the sea.
O. 762	996
L. 680	914
G. 420	654
E. 344	518
D. 308	542

Feet above the level of the Lake inland.	Feet above the level of the sea.
C. 280	514
B. 208	442
A. 108	342
Level of Lake Ontario,	234

That an inland sea existed, subject to successive drainage, at outlets of different elevations, and consequent changes of level and reduction of extent, is rendered probable, and even certain by facts. If we glance at the topography of the United States, we find an immense basin, bounded on the north by the range of mountains extending through Canada to the far west, on the east by the New-England range, extending southwesterly, by the Highlands of New-York and the Alleganies to Pennsylvania ; thence west and south towards the Mississippi river. From our present knowledge, we cannot speak with certainty regarding the continuation of this barrier beyond the Mississippi, but it is quite probable that it extends to the base of the Rocky mountains.

Previous to the denuding action which has produced the present water courses, these ranges presented a barrier to the enclosed waters of 1,000 or 1,200 feet above the level of the ocean. It has subsequently been broken through by the St. Lawrence, the Susquehannah, the Hudson, and partially by the Mohawk at Little-Falls. It is rendered quite probable, also, that the Connecticut river once formed the outlet of this immense sea. The vast quantity of boulders, and other transported materials, covering the surface of Long-Island, and which can be traced to rocks in place in Connecticut, prove that a violent and powerful current has at one time flowed down the valley of this river. A stream of the magnitude of the St. Lawrence, Mississippi and Susquehannah united, would produce this effect, and such a stream probably flowed down this valley, as the outlet of the great inland sea, till that was reduced below the level of 1,000 feet above tide water.*

All the outlets to this great basin are of comparatively modern origin, and furnish no valid objection against the existence of an ancient inland sea, which covered a large portion of the interior of this continent. In regard to the St. Lawrence, we have some information of the evidence that this river formerly flowed out at a much greater elevation, and that it has excavated for itself a channel in the rocky strata towards its mouth. We have also more conclusive evidence of this fact, in the course of the Susquehannah, and also in the channel of the Mohawk, excavated through the primitive barrier at Little-Falls. The Hudson has at one time found a barrier in the Highlands, which has been removed by the combined agency of its own waters and those of the St. Lawrence,* or indeed of a much larger amount of water than now flows in both these rivers.

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* The elevation of the valley of the Connecticut, near its head waters and its junction with the valley of St. Johns river, is less than 1,000 feet above the ocean, as I am informed by Mr. Roy, who suggested that this might have been an original outlet of the ancient inland sea.

Thus far we have no data to guide us regarding the barrier across the Mississippi, or precisely at what point it existed. It appears, however, to have been one of the last formed outlets to the inland sea.

In the western part of the State of New-York, many of the valleys may have been deepened or partially formed by the passage of the waters of this sea to the great outlet south, (the Susquehannah.) The lowest elevation between the valley of Cayuga lake, and the Susquehannah at Owego, is 981 feet. This corresponds nearly with the base of the highest margin of this sea, which Mr. Roy has observed in Canada, (viz : 996 feet,) at which point he observes, the inland sea must have remained stationary for a long period. The elevation of the valley between Seneca lake and the Chemung river, is 890 feet. Mr. Roy recognizes in Canada, a well defined margin at 914 feet. It therefore follows, that a discharge of twenty four feet in depth, took place through this valley at that period ; and we have evident marks, in the character of the valley and the transported materials, that a violent current has passed through it. At this period, we know that the discharge by way of Owego to the Susquehannah had ceased. The valley from Seneca lake to the Chemung river, must have been the principal, or almost the only outlet when the water was at this elevation; all the valleys farther west, being higher, and therefore only partial outlets when the elevation of the water was greater.

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* It may be objected to this view of the subject, that the barrier across the Hudson at the Highlands, could never have been 1,000 feet above tide water. This may always have been the elevation of these hills, and the Hudson, in that case, formed one of the earliest outlets of this sea. There may have been, also, some change in the level of the land since that time, for we know that the tertiary of Lake Champlain is deposited upon rocks which are scratched and worn by the current formerly flowing in this valley, and which came by the way of the St. Lawrence. Since that time, this basin has been submerged beneath the ocean, the tertiary fossils have lived, died and been covered with clay, sand, &c. and the whole raised to its present elevation ; whether it be the same, or higher or lower than it was before the submergence we cannot at present determine,

The opening of other channels, (probably the St. Lawrence and Mohawk,) at a lower level, caused the discharge by the Chemung to cease, and from this period we have only these two outlets for the sea on the east. The discharge in these directions, continued till the separation of the upper and lower Lakes, which took place when the inland sea was reduced to about 600 feet above tide water.

After the discharge by the Mohawk had ceased, which it did when the waters subsided to the elevation of 400 feet, the course of the St. Lawrence was by the valley of Lake Champlain and the Hudson river. The observations of Prof. Emmons, show that when the waters of this sea were at an elevation of about 300 feet above the ocean, an extensive discharge took place from the south end of Lake Champlani, as is evidenced by the polished surfaces and the wearing away of the rocks. At this period, a large proportion of the waters of the inland sea were discharged by the St. Lawrence and Champlain, into the valley of the Hudson. The partial obstruction at the Highlands, was the cause of the immense accumulation above; and the flow by the Mohawk having nearly ceased, the eddying currents deposited the immense body of clay and sand, forming the plains between Albany and Schenectady, and which extend still farther north and south.*

These conclusions seem incontrovertible, so far as regards the eastern portion of the great basin once occupied by the inland sea. The Allegany could never have formed an outlet, but as before observed, must have discharged into this sea. There are no valleys communicating between the Allegany and Lakes Erie or Ontario, at a lower elevation than 1,200 feet. This river itself, within the State of New-York, has an elevation of nearly 1,200 feet above tide water.

A barrier across the Mississippi of less than 700 feet above tide water, would turn all the waters of that immense valley, by way of the great lakes, and down the St. Lawrence. Of the existence of such a barrier we do not doubt, but at present, we have too little accurate knowledge to point out its location, or the means by which it has been removed.

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* The sand of these plains, as well as the great numbers of sandstone, boulders and pebbles, are clearly referable to the Potsdam sandstone, which once formed the barrier at the south end of Lake Champlain. See the reports of Dr. Emmons and Mr. Mather.

The excavation of the basins of the great Lakes, is a subject still involved in obscurity, if we suppose the relative levels of land and water to have been always what they now are. The deepest of these are 600 feet below the level of the ocean. The original excavation of the bed of Lake Ontario, was in the rocky strata, which have been removed to the depth of from 200, to nearly 400 feet below the level of the ocean. Subsequently this basin has been filled, or partially filled with alluvial materials. The shores where rocks are not visible, consist of clay, sand and gravel, possessing the same character on either side of the lake, and evidently the same deposit.* Whether this deposit ever extended entirely across the lake, or only to some distance from the present shores may be a matter of question.

The great depth of the bed of Lake Ontario, proves beyond doubt, that it could not have been excavated whilst the present depth of water existed, even by the most powerful current. The occurrence of the tertiary of Champlain, proves that place to have been depressed at least 300 feet below its present elevation ; if that depression was communicated westward, the former bed of Lake Ontario may have been laid nearly dry, by the waters having found a ready outlet to the ocean. If at this period all the waters of the great inland sea, passed in this direction, the bed may have been excavated. It would however, better account for this great depth, could we prove that its bed had been raised, and after being excavated, again submerged. May not the depression of the eastern portion of the State, have caused a corresponding rise to the westward ?

The valleys of Western New-York, so far as examined, all aid in proving the foregoing statements ; and if we can find that those which are excavated deepest have been the largest water courses, we have another fact in proof of our position. The discharge by way of Cayuga lake to the Susquehannah, continued till the inland sea was reduced below the level of 980 feet. Seneca lake and the valley south, continued to be an outlet till the level of this sea was reduced below 890 feet above the ocean. Now we find the depth of Cayuga lake to be less than 400 feet, and that of Seneca lake more than 500 ; both are excavated in the same rock.

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* The shores of the lake generally present, as the lowest stratum, a blue or variegated marly clay, surmounted by a few feet of white or yellowish clay, and above this, sand. Sometimes gravel is deposited in what appear to have been excavations in this clay.

In tracing these valleys we find them all continuing southward, and beginning at the north we find the greater part of them tending towards the Susquehannah, which no doubt at a very early period found an outlet to the inland sea. The valleys of Cayuga, Seneca, Crooked, Canandaigua, Honeoye and Hemlock lakes,all communicate with the Susquehannah, by the Chemung and Conhocton rivers.

The most extensive, and well defined valley west of Seneca lake, is the Genesee. The term Genesee valley, is usually applied to that portion between Rochester and Dansville, this maintaining nearly the same elevation ; that followed by the Genesee south of Portage, being a distinct valley. The conditions under which this valley has existed, will be an explanation for the others, as they have nearly all been more or less under the same influences. In whatever manner we choose to explain the production of this valley, we must admit that it is a valley produced by excavation, and that this portion of country was originally covered by rocks, which formed continuous strata with those now seen on either side. From all facts yet observed, it appears that such valleys have been excavated by violent and powerful inundations, which have torn up rocky strata, and carried forward the materials to places farther south. The course of the advancing or excavating wave in this case, was from nearly north to south, passing all that portion in Livingston county from Rochester to Dansville, when its course is well defined. Beyond this point it passed southevsterly by way of Arkport, Hornellsville, Canisteo, &c. to the Chemung river, and thence to the Susquehannah. This valley could never have formed an outlet for the inland sea for any length of time, for its elevation between Dansville and Hornellsville, is more than 1,100 feet above the ocean. It is here very obvious, that the original valley did not follow the course now taken by the Genesee river, for we find that stream descending to the level of this valley from Portage, by falls and rapids of more than 500 feet.

It would appear that the excavating wave divided near the junction of the Caneseraga and Cashaqua creeks ; the larger portion excavating the valley to Dansville, Hornellsville, &c. the other by Portage and

Angelica, or the one in which the river now flows from its source to Portage. At the south line of the State, this valley is probably not less than 1,600 feet above the ocean. When the waters were at this elevation, the margins of the ancient sea could scarcely have been defined, for having so many outlets, it would remain at no settled elevation for any considerable period.

The subsequent condition of this valley has been one of great interest. After the waters had ceased flowing in so many directions, and the inland sea was reduced to its first stationary point, that portion south of Portage, was left as a lake of the same dimensions as the valley at the present time, with all the small streams and the sources of the Genesee flowing into it. This lake discharged its waters by a gradual descent into the inland sea, which at that period was little below it. At subsequent periods the inland sea was so far reduced, that the lower valley, or that between Rochester and Dansville, was left a shallow lake, having its outlet by way of the Irondequoit, and more recently, by way of Rochester. During these periods, the streams flowing into the valley, at, and about Dansville, brought down loose materials which were deposited over the bottom of the lake, the finer materials being carried forward suspended in water. This was also the condition of the discharge from the upper lake, by way of Portage; pebbles, sand and mud were brought down, the coarse materials being deposited first, while the finer were carried forward and deposited in more quiet water.

An examination of the Genesee flats furnishes sufficient proof of this theory. For many feet in depth the deposit consists of fine sand and clay, intimately mixed, the same materials which are now being deposited in every lake by its tributaries. The evidence does not rest here, for if we examine this deposit, we find lines of stratification or deposition, the direction sloping from south to north, and the very same which we should expect, if the materials composing it were pushed gradually forward over the bottom. The first deposit would be made at the embouchure, and would consist of a mass sloping off towards the centre of the lake; the next would follow this, a second and third deposit in the same way, would continue the slope towards the north. As we advance towards what we suppose to have been the inlets of this lake, we find the materials of such character, that they could not have been brought down by any except a powerful current.

To understand this more fully, we may take for example any ot our shallow lakes or ponds, which are now being filled up by materials brought from the higher grounds, by freshets and the small tributary streams.

While this state of things existed in the lower valley, nearly the same process was going on in the upper one. The fine materials brought down by the streams, were spread over the bottom, while the coarser were left on the margin, at the mouths of the inlets. The outlet by the Cashaqua, seems to have been early closed and another formed by wearing the chasm from Portage to Mt. Morris. During this period, the lake was drained to near the present level of the river bed. The different and successive margins or shores of this lake are in many places clearly recognizable, but in others they are obliterated. The first opening for the water of this lake was from Portage, in nearly a direct line to Rogers' bridge, through a gorge now filled with alluvium. After the water was drained in this manner, from some cause, and probably the sudden drainage of a small lake at a higher level, a great accumulation of water occurred, which, carrying everything before it, swept down the alluvium, which completely blocked up the course of the stream, producing that immense deposit to the north of Portageville. The consequence of this catastrophe was the accumulation of water in the lake above, to such an elevation, that it found a passage over the surface along the present course of the river from Portageville to the Lower falls. The direction of the outlet being once given, the wearing process commenced and the result has been the production of that immense chasm in which are situated the three falls. The descent of water over these falls and intervening rapids, amounts to about 400 feet. The perpendicular cliffs of rocks below the second fall are 350 feet high.

Here then, are two eras, clearly distinguishable, in which the different portions of this gorge have been excavated, and both of them since the present configuration of the surface had become generally settled; and long since that period, when the whole was submerged beneath the ocean.

In the excavations in the alluvium now at progress at the north end of the tunnel at Portage, we find the first deposit somewhat regular, and consisting of materials in which those of northern origin form a part. This deposit appears to have been partially excavated and another deposit spread over it, of materials from the south, consisting of flat masses of sandstone and scarcely worn pebbles, with loam, &c. distinct from that below. This deposit proceeded from a second eruption, after the first opening was closed up, and was probably made at the period when the river commenced flowing in its present course.

There are several other places between Portage and Mt. Morris, where the direction of the river has been changed since it commenced its course through these rocks. The chasm for two or three miles above Mt. Morris bridge, appears more recent than some portions between that place and the lower falls, and it is not improbable that a portion at least of the waters of this river flowed through a gorge little to the north of the present one. The valley by way of Silver Lake, has at one time served as a water course, probably for the waters of the lake above Portage.

A partial history is thus presented of the changes which have taken place in the Genesee valley ; further and more minute investigation will doubtless detect others, though of less importance and magnitude than those enumerated. Although the same phenomena are exhibited in other valleys, I have seen none where they are exhibited so clearly.

The Genesee valley is a prominent feature in the surface of the counties of Livingston and Allegany, all the others are of minor importance, or lateral and tributary valleys. That of Conesus Lake is an inconsiderable one, the depth of the lake being but fifty-seven feet ; the valley in its continuation south joins the Genesee valley north of Dansville.

The valley of the Caneadea creek has probably drained a lake which once existed in the neighborhood of Rushford village. Many of the deep ravines, some of them with small streams still flowing into them, are the outlets to higher lakes which have been thus drained.

The principal valleys west of the Genesee, are for the most part not so well defined or continuous, though some of them are deep. In Genesee county, we have the valleys of Allen's and Tonawanda creeks ; towards the sources of these streams the valleys divide, and gradually rise to near the general level of the surrounding country, still their course can be traced joining the valleys extending south to the Allegany. The more elevated country, between these north and south valleys has once been occupied by lakes which have been gradually drained, some in one direction and some in the other.

The great depressions on the south and west, the valleys of the Allegany river and Lake Erie, have given direction to all the water courses of Cattaraugus county and the southern part of Genesee.

The valley of the Olean creek from the north joins the Allegany at Olean, and at this junction is much expanded. This valley may be viewed as taking the course toward the source of the Allegany, having the same direction as the valleys farther east. West of Olean, we have the two valleys from the north, known as the Great and Little valleys, which join the Allegany at its most northerly bend. From this point it would have been little deviation from the general course, for these valleys to have followed the Allegany valley, either southeast towards its source, or southwest in the present direction of the stream. Reasoning from analogy with other valleys of this region, we should suppose such to have been the former direction of the excavating power of these valleys. The evidence at Lodi and other places in that neighborhood, clearly prove the existence of a large north and south valley in that direction ; the same appearances exist at the sources of Great and Little Valley creeks, and the south branch of the Cattaraugus.

The course of the Cattaraugus creek is in a bed or valley of recent excavation, produced by the accumulation of water at its source, and the sources of its tributaries.

The Ischua creek flows in the bottom of an ancient valley, which at Hinsdale is joined by the Oil creek, also in an ancient valley. The valley of the Ischua, is easily traced north as far as Machias, when it spreads out to considerable extent. Between this place and the Allegany, it presents a general broad flat plain, gradually descending to the south, and limited on each side by ranges of hills. Its further continuation north by the valley of Lime Lake, thence northward to the Cattaraugus is in some measure obscured by alluvial hills. For some distance south of Machias, the bottom of the valley is covered with a fine loam, resulting doubtless by deposition from water, while all this portion was covered by a lake.

The Great and Little valleys, the Conewango and Cold-Spring valleys, all apparently result from the division of one large northern valley, which at Waverly takes these several directions. The country about the sources of the Conewango is extremely level, giving rise to extensive swamps.

South of the village of Lodi, and between the Cattaraugus creek and the Conewango, the side of this valley exhibits numerous terraces in the alluvium, proving the former elevations of the lake, which has been finally drained, leaving indications of its former existence in the swamps just mentioned.

The facts here stated regarding these valleys, are such as should be expected, when we take into consideration the condition of this continent as it emerged from the ocean, or was deluged by a mighty wave. The water would flow off rapidly in every direction, till it fell below the barrier, which on every side confined it. Even above this point, however, there may have been places so surrounded, as to have retained the water at much greater elevations. These would form elevated lakes, which from time to time have burst their barriers, and swept over the country below ; or by a gentle and gradual drainage have formed those deep ravines, through some of which still winds an insignificant stream, the only representation of its former grandeur. From time to time the great inland sea found new outlets, which drained off a portion of its waters, changing the surface of the country, and deluging whole tracts with alluvial matter carried down by its resistless torrent.

From what has been said regarding the ancient direction of the waters, we are prepared to find the alluvial soil composed of northern materials. The current of which we have every where abundant evidence, traversing the country from north to south, breaking up the strata and carrying forward their materials in its course, deposited the debris in the state of boulders, pebbles and sand, in every place where it passed.

As this wave excavated deep valleys, and left large portions in the form of hills, the materials were deposited at the lower levels by the more gentle currents which followed the first. Thus we find that the valleys, and hill sides to a certain elevation, are covered often to great depth, with a soil of foreign materials. These may be traced to rocks in place farther north ; limestones of the northern counties, and granitic rocks from Canada, worn and rounded, and mixed with all the intervening ones on their southern course. Sometimes the deposits are local, the materials consisting of a few rocks in the immediate vicinity; in such cases we shall probably find a local cause, as the outbursting of a lake, or the embouchure of a large water course.

From the conditions under which the transported soil was brought into its present position, it must necessarily be of varied character. Where thrown down by a violent current, it is a confused mass of sand, gravel and pebbles; where deposited by less rapid waters, finer materials are found; and where the waters had become more quiet, clay which remains longest in suspension, is spread over the surface. Many causes may have modified the results.

The soil of the hills consists principally of the comminuted materials of the substrata, and varies with the nature of those. It is generally, rather clayey gravel, or loamy, and contains numerous angular, or slightly rounded fragments of the underlying rocks. Primitive boulders are sometimes found on the surface, but their great proportion is confined to near the limits of the alluvial transported soil. The hill soil, is never very deep, the rock being frequently reached in ploughing; and when removed from the more abrupt declivities, the surface of the solid rock is found covered with flat angular fragments of all dimensions, which have apparently been but loosened from their original position, and have fallen down the hill.

The formation of this soil, and the occurrence of the great number of angular fragments, can only be explained on the supposition, that the hills have been covered with water; which gradually retiring, and being agitated by winds and somewhat by currents, has broken up the rocks, and formed the soil without removing it out of place. It does not appear that there were any violent currents, these only affecting the parts near the outlets, and above a certain elevation, the whole might have been very gradually drained by numerous outlets, and no rapid current caused in any direction. Subsequent effects of freezing and thawing, rains, &c. may have modified the character of this soil, for the frost usually penetrates to the rock beneath. And much indeed bears evident marks of having been formed by the gradual decomposition of the mass, with no more change than may be produced by the actual vicissitudes of the climate.

We have then in the southern counties two soils, essentially differing from each other. The rocks of this region being nearly destitute of lime, it follows that the soil resulting from them, bears the same character; that of the valleys being produced by the destruction of northern rocks, contains the materials of those rocks, or a large proportion of lime. These facts are known to every farmer, and wheat is never grown on the upland soil, although the conclusion may not have been attained by the same course of reasoning, the results are the same, relied on and confirmed by practice.

As a general rule, the finer materials of the valley soil, will be found towards its outlet, and the coarse near its head and along its margins, the latter being irregularly accumulated, according to the direction and quatity of the water received and transmitted. Sometimes the finer deposits are found covering the coarser, or vice versa; this must be either from a change in the direction of the main current, or the suppression or augmentation of some lateral one. The valley or one side may be covered with coarse materials, and directly opposite may be a finer deposit; this results from similar causes.

In the Genesee valley near Angelica, we find an extensive plain of sand, supporting a large growth of pines; it presents some features differing from the surrounding valleys. The circumstances of its formation were these: while this upper valley remained a lake, the Angelica creek, then a much larger stream, flowed into it a little distance south of the present outlet, in a direction nearly at right angles to the current passing through the lake from south to north. The meeting of these two currents formed an eddy, which crossed to the eastern side of the lake, and deposited the finer materials, which the more rapid stream had before held in suspension.

Similar eddy currents have produced accumulations of sand, clay, &c. over greater or less areas; and these differing from the surrounding soil, are often characterized, as in the present instance, by a different vegetation. Maple and beech trees grow luxuriantly over the alluvial soil; while evergreens prevail among the hills, whose forests of dark and stately pines have a character peculiarly wild and sombre.

Swamps.—The swamp deposits consist usually of a substratum of clay or sand, covered with vegetable, muck or peat, with sometimes an intervening layer of marl. The history of many of these, comes almost under observation. First, a shallow pond deposits the clay, &c. held in suspension; next succeeds a growth of aquatic plants, which decaying, cover the bottom; this is annually repeated until the pond becomes a marsh; other plants succeed, and the accumulation goes on.

Lastly, when dry by evaporation or drainage, the vegetable matter has become compact, and firm enough to form peat, and is used for fuel The deposit of marl takes place prior to the growth of vegetation ; and results from the percolation of water through the alluvial soils, which contain large proportions of lime. When swamps occur in places where there is no alluvium or limestone, there is no marl.

The number of swamps containing muck, is exceedingly numerous. This deposit in the fourth geological district, has but in few instances become sufficiently tenacious to be called peat ; though it burns as readily, and is equally good for fuel. In drying, it falls to powder, not containing enough undecomposed particles to cause the mass to cohere. Sometimes the muck is deposited on a sandy bottom, when it is never so abundant as on clay. This understratum of clay is often very valuable for bricks. In many places, when the swamps shall have been drained, and time allowed for the muck to become more compact, and other vegetation to succeed the present, many of these deposits will become valuable fuel.

Tufa and Marl.—These terms are applied to the same substance in different states of aggregation ; both being a deposit of lime, from solution in water. The former is hard and porous, embracing vegetable impressions, and leaves and branches, which have been replaced by lime. This form results when the deposit is made from water passing over a surface or oozing from a hill side ; in the latter, the lime is precipitated under water in shallow lakes, ponds, &c. and from its manner of deposition, cannot cohere.

A bed of tufa, which appears to be not very extensive, is seen in a hill N. E. from Dansville, on the land of Mr. Brewer. This has been burned for lime. Large quantities are obtained for that use at another locality in the same town, which I did not visit. On the Canisteo, a mile and a half from Bennetsville, a spring rising at a level of 60 or 70 feet above the river, deposits calcareous matter. Near the source of the spring, the lime has accumulated, and the stones for some distance in its course are covered with the incrustation. Several similar springs are found in the neighborhood.

Two miles northeast of Arkport, tufa is burned for lime, which thence supplies that part of the county. It was formerly burned at a place south of the village. At Pogues Hole, on the Canesaraga, at Troupsburgh, and in other places, tufa and marl are burned for lime. Two and a half miles east of Angelica, a bed of tufa has been worked for several years ; the best portions only are used, and so little care taken, that much is unnecessarily destroyed. A mile and a half east of Portage, near the residence of Mr. Paine, there are several beds ; and two of small extent near Roger's bridge ; one of these is opposite the lower falls ; the other at the entrance of the gorge below the little flat, on which Lefoy's mill stands.

Two deposits of marl occur in the town of Rushford ; one underlying a swamp, on the land of Judge Mc Call ; the other near the road. Also at Caneadea, there is a small deposit a little above the level of the valley. At neither of these localities has it been used for lime.

In Livingston county a mile east of Caledonia, an extensive deposit of marl occurs in a recently drained swamp. Another north of this town, and extending into it, was described in the Report of 1838.

Near Batavia, several small swamps or ponds contain marl, and also the springs or ponds, the source of Spring creek. About three or four miles north of Leroy, between the gypsum beds and Bergen, there is a large marl swamp ; the extent of the deposit I did not learn, but it is probably great, resulting as it does, from the marls and slates of the gypseous formation. Two and a half miles south of Leroy, on the land of Archibald Stewart, and an adjoining farm, a marl bed covers about twenty acres, with an average depth of probably eight feet ; a few rods from the margin being five, a little distance farther nine, and the centre fifteen feet. This marl is covered by muck, from one to two feet thick. Mr. Stewart has applied the marl as manure, and finds ample returns.

In examining Silver lake, I found the bottom in many places covered with a growth of Chara, which when first thrown out looks green, and on a little exposure becomes white and brittle, readily crumbling to powder ; they are almost wholly composed of carbonate of lime. The same species is found abundantly in the outlet of the Caledonia spring ; and so rapid is its growth, that frequent removals are required to prevent it from impeding the water in the sluiceways to the mills.

Towards the inlet, the bottom of the lake is covered with marl several feet deep, but I was not able to ascertain whether it occupied the whole area. From sounding, the bottom appeared soft. The marsh at the head of the lake was not examined ; it probably contains marl.

In all deposits of tufa and marl, a large quantity in the bottom of the bed is earthy, and considered unfit to burn for lime; these portions either in their actual state or burned, can be advantageously used for agricultural purposes. Lime burned from this, and made into a compost with the black muck of swamps, would be an excellent manure for all the lands of the southern counties ; and even the hardpan, which is considered almost worthless, may be reclaimed, and rendered fertile by the judicious application of muck and lime. The importance of this subject cannot be too strongly urged. While the farmer is perhaps cultivating a poor, hard soil, too compact for vegetable growth, his lands include perhaps a muck swamp, which is considered nearly worthless. Now by ditching his swamp, and carrying its contents on his field, both are essentially improved. The soil of these swamps, when reclaimed, is superior to the higher grounds.

Whiting Merry Esq of Wheatland, has for many years been making experiments with these substances, and the results meet his most sanguine expectations. In using either marl or muck, fifty loads are mixed with two hundred and fifty loads of barn manure, straw, &c. and allowed to remain in a heap for several months. The marl compost used on grain lands, produces stronger and better straw, with larger crops.

The muck compost, was used on a field previous to sowing with wheat ; twenty acres received a " top dressing" of twenty loads to the acre, and ten acres were left unmanured. From the twenty acres, were obtained twenty six, and from the ten, only seven bushels per acre ; the latter being as good or better land, and sown with the same grain. The average crop the same year, on a soil somewhat superior to this field, was nine bushels per acre.

In the spring of 1839, a field was " top dressed " with twenty loads in the same manner, and planted with corn, it yielded 60 or 70 bushels to the acre. In addition to the increased crops, the land is thus made light and easily tilled. The addition of a little lime to the muck composts, is of great importance.

No manure can be better adapted to the unproductive hardpan soil, which covers some of the hills in the southern counties. The deficiency of lime and vegetable matter can be thus supplied, and the soil rendered light and productive.*

Clay.—Almost every town contains this substance, in sufficient purity for brick making. It underlies many of the swamps, is found along the sides of the Genesee valley, and in almost all the low grounds, it appears as the last deposit of the subsiding waters.

Springs.—Those of pure water are abundant in the southern counties, gushing out from the hill sides, and sending cool and refreshing streams along the valleys.

Hydrosulphuretted springs are very numerous. The most important of these are at Avon, Livingston county; these have already been examined by Dr. Beck.† They have their origin like those of Manchester, Ontario county, in the hydraulic limestone, near its junction with the limestone above. The upper spring is at too high a level for this, but from information obtained, the water rises from a rock, fourteen feet below the surface of the soil where it appears. The Avon springs, are very copious and highly impregnated. There are three or four at nearly the same level as the lower spring, and one still lower in the valley, has recently been fitted up for the accommodation of visiters.

So far as my observations extend, all the copious sulphur springs in the fourth geological district, arise from the hydraulic limestone. Small springs of this kind, occur in nearly all the shales above the Onondaga limestone. One of these is found at Moscow, several in Steuben, at Cuba, in Allegany; and in Cattaraugus.

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* For important information on the use of peat or muck, see the Report of Dr. Jackson, Geologist to the State of Maine, for 1839.

Note.—Among the applications of marl to economical purposes, the following is, I think, new. During the last summer, I met in Ontario county, an itinerant, who was vending an article for cleaning knives, silver, brass and copper utensils, and it was likewise recommended as a *dentifrice*. Large quantities had been sold to universal satisfaction. The fine variety, proved to be a fine pulverulent marl, moulded into the form of a brick; it still contained small freshwater shells. The other was a more siliceous variety, probably containing some of the microscopic infusoria. In many places where this was sold, thousands of loads could be obtained within a mile.

† See Report of Dr. Beck, for 1838.

Carburetted Hydrogen.—This gas, rises from springs and streams in many places in the southern counties; and can be detected by applying the flame of a taper to the bubbles, which readily ignite.

The oil spring of Cuba, was noticed in Mr. Vanuxem's Report of 1837. There is a similar one in Freedom, Cattaraugus county.*

Springs slightly impregnated with saline matter occur in a few places; one of these is on the land of Mr. Davis, in Greenwood. Mr. Horsford mentions one near Rutledge village, Conewango.

The most copious, and strongly impregnated saline, which I have found in the fourth geological district, is in a marsh, in the town of Elba, Genesee county, on the land of John G. Satterlee. This spring rises from the true saliferous formation, and therefore merits a more extended notice. When I saw it, the water was flowing from one place in quantity, about as much as a common pump would supply; decidedly, and strongly salt to the taste. The vegetation is destroyed for several rods around the opening, and there are indications of another spring coming into this from the west. In the adjoining lot east, there is a spring, and several more in the vicinity; all however far inferior to the first mentioned. Salt was formerly manufactured from the water of this spring, or from wells dug in the margin of the marsh.

The rock is eighteen feet below the surface, and the portions brought up in digging, are a grey marl, with gypseous seams and nodules; and it is apparently the marl below the first regular bed of gypsum. Several years since a well was dug to the rock, and below a boring of four inches diameter was made fifty feet further. A wooden tube of two inches calibre was then placed in the hole, and the water immediately rose several inches above the surrounding surface, and flowed out, keeping the tube constantly filled. At this period, and for some time a larger quantity of water flowed off than had risen in the well previous to the boring; and the vegetation for some distance was entirely destroyed. Since that period it has fallen into neglect.

Being in the same rock as the springs at Salina, it may at some time be thought worthy of investigation; especially if those waters diminish or deteriorate.

The acid spring mentioned by Dr. Beck, in the Report of 1838, and previously by Prof. Eaton, lies in the S. W. corner of the town of Byron. At present no water flows from it, though the soil a few inches below the surface is quite damp. The place presents a low, blackened mound of earth, entirely destitute of vegetation. The surface is composed of vegetable matter, intensely sour to the taste; this is underlaid by clay or sandy clay, equally sour. Dr. Beck, states this earth to contain no other principle than dilute sulphuric acid. Several large stumps stand upon this mound; the decayed roots, and perhaps the trees themselves have furnished the vegetable matter which is charred by sulph. acid.

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* See Appendix.

I was informed, that in the early settlement of the country, a copious spring of intensely sour water issued from the top of the mound; that in digging about the spring, for the purpose of making it deeper, the whole was lost, and since that time it has only appeared in the spring of the year. The rocks below are the gypseous marls, and nearly, or quite the same as those of the sour wells in Bergen. The source of this spring affords sufficient water in the driest part of the year, to moisten the ground for the distance of several rods around.

Saline efflorescences.—These are abundant in some of the dark shales of the Gardeau group; in several places along the Genesee, several pounds of alum and copperas, may be obtained from an extent of a few yards. In the upper black shale, the same character is observed; and also to some degree in most of the other shales.

In Darien, Bennington, Sheldon and Orangeville, Genesee county, the waters of many springs are tinged with iron. This I suppose to be attributable to the proximity of the shaly rock; which containing iron pyrites, the decomposition causes the deposit from the water. The Crinoidal limestone of Darien contains pyrites, being overflowed by water, which leaves a rusty deposit.

In conclusion I have to say, that while I have omitted nothing that can be regarded as important to the interests of the inhabitants, or aiding them in the knowledge or direction of their available wealth, I have omitted details which can be of no present utility, and which may, by seeming to attach undue consideration to things which are only contingent and prospective, have a tendency to mislead. For example, masses of beautiful stone, marble, beds of peat, marl, &c. I have not calculated by the cubic foot or yard, as if already worked out and sold; whence the farmer or speculator, regarding only the ultimate value of his wealth, increases his price according to this essentially false estimate. For it must be considered that years are required to consume a marl bed, a peat bog, or a marble quarry; that the income depends on the demand; and though its stated value may be realized in twenty or fifty years, the capital invested in its purchase might, in the mean time, and otherwise employed, yield four fold. Like the products of a cultivated farm, the returns are constant and slow, differing from that only in the circumstance that it is not inexhaustible.

I would not be understood as attaching little importance to such property. To the farmer the value of a marl bed or a peat bog is immense; but I would say, that geologists, when occupied in such objects as calculating the value of a mass in dollars, while they degrade their science, defeat their own purpose; they mislead those who are guided by their representations, and foster the very spirit which their researches should allay, viz. *the mania of speculation.* If such a course is pursued, it requires no great foresight to perceive, that want of confidence, and finally distrust, will prevail, and geology be ranked with the art of the adventurer with the mineral rod. Besides, there is confessedly, room for error in estimating the contents of a bed or vein. In the 4th District, we know that beds of limestone, marble, grindstone grits, &c. are liable to thin out within a few rods, or they may continue for miles: in this state of the case, it is very unsafe to predict or infer that one stratum will extend for a distance of several miles because another one has been found to do so, when we know the greater number do not.

These reports are intended to be the medium of information to landholders, farmers and others, of what their domains produce, of their application and uses, and the value in general terms. These remarks may, perhaps, be out of place in a report of this kind, but I have been induced to make them, from the many examples which have come to my knowledge, where the value of a manufactured or wrought material of a mass is given, and the same applied to it in its present or natural state, from whence it is plain that loss and disappointment must follow. It has before been said that the permanent growth of wealth in the Western District consisted in the agricultural value of the land. The two northern ranges of counties affording a soil peculiarly adapted to grain growing, no country being superior to it; while the nature of the substrata, soil, hills, ravines, and numerous perennial springs of the southern tier of counties, characterizes them as grazing lands, and they only require a little more capital, and better means of communication, to become the abodes of plenty and contentment.

The following is a table of the rocks of Western New-York, in the order of succession, with their reference to the subdivisions of the "Silurean System." In most cases, the limits of these subdivisions are clearly ascertained, but it must be recollected that the Onondaga Saliferous group, or that mass containing all the plaster beds of the fourth District, appears to be wanting as a member of the Silurean system in England and Wales. The limestones of the Helderbergh and Schoharie accord better with the description of the Wenlock or Dudley limestone, than those of Western New-York, the latter being much thinner.

The Lockport limestone is evidently referable to the Dudley period, and so also are the Onondaga and Seneca limestones; consequently the saliferous group lying between these will be included in the group. The former of these limestones contains many fossils which are common to the Wenlock limestone, and at one locality in Monroe county specimens were collected containing great numbers of a small species of Orthis which occurs at Dudley, the specimens from both localities closely resembling each other, and each highly charged with the same fossil.

The table exhibits the arrangement so far as the limits of the groups have been ascertained, but the groups of the "Silurean System" do not well accord with the natural divisions of the rocks in New-York.

Old Red Sandstone.	Old Red Sandstone.
Chemumg Group. Gardeau and Portage Groups. Ithaca Group. Cashaqua Shale. Moscow Shale.	Upper Ludlow Rocks.
Ludlowville Shale. Calcareous blue Shale. Dark olive Shale. Marcellus Shale.	Lower Ludlow Rocks
Seneca Limestone. Onondaga Limestone. Oriskany Sandstone. Hydraulic Limestone. Onondaga Saliferous Group. Lockport Limestone.	Wenlock Limestone.

Rochester Shale. 2d Green Shale.	Wenlock Shale.
Pentamerus Limestone. Green Shale and iron ore. Medina Sandstone.	Caradoc Sandstone.

The following series exhibits the rocks of the 4th District in their order of succession, together with the names of a few of the most common and characteristic fossils. The list of fossils will be greatly increased when we succeed in ascertaining the names of species.

Old Red Sandstone.	Holoptychus Nobilissimus, Sauritolepis Taylori.* Fragments of teeth and bones of other fishes, probably the Megalicthys.
Chemung Group.†	A large Avicula is the characteristic fossil of many localities—Pterinea, Leptæna, Delthyris, Orbicula, three species, Tentaculites tenuis; several coralline fossils.
Portage Group.	Goniatite, rarely; Fucoides, vertical to the strata. The fucoid is the characteristic fossil.
Gardeau Flagstones.	Fucoides, arranged in short, rigid fragments, on the under side of the strata—seen on the surface of flagstones in many places. Other species of fucoides.
Ithaca Group.	Orthis, Leptæna, Delthyris, species undetermined; Fossil ferns.
Cashaqua Shale and Sandstone.	A large Avicula, Goniatite, Posidonia, Crinoidal joints, &c.
Upper Black Shale.	Posidonia lirata; Lingula, two species; Orthis, Orbicula.
Tully Limestone.	Atrypha ——— —, few fossils.
Moscow Shale.	Calymene bufo, Cryphæus calliteles, Homonolotus —, Atrypha affinis, A. prisca, Delthyris, several species.
Encrinal limestone.	Asaphus, (new species,) Avicula reticulata,(?) Crinoidal columns of great size.

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* I have proposed the specific name of what I suppose to be an undescribed species and genus of a fossil Sauroid fish, in honor of Mr. R. C. Taylor, of Philadelphia, who first described the sandstone of Blossburgh, and suggested its analogy to the Old Red Sandstone of England.

† This group requires subdivision before it can be accurately described.

Ludlowville Shale. (upper part.)	Atrypa concentrica, Leptæna, Delthyris, Calamopora Gothlandica, Favosites, Cyathophyllum, several species.
(lower part.)	Several species of Pterinea, Strophomena carinata.
Compact, calcareous blue shale.	A few undetermined species are peculiar to this mass.
Black Shale, (pyritous.) Marcellus Shale.	Posidonia lirata, Orbicula, (small,) Orthis —, Pterinea ——, Leptæna Spinulosa ?
Dark, or olive Shale.	Orthis ——, Delphinula ——.
Seneca Limestone.	Strophomena lineata, Cytherina —, Favosites.
Onondaga Limestone.	Icthyodorulite, Odontocephalus selenurus(*Asaphus selenurus*,) Calymene bufo, or C. macropthalma, Atrypa Wilsoni, Strophomena rugosa, Leptæna indenta, Cyathophyllum ceratites, Favosites.
* Oriskany Sandstone.	Ichtyodorulites. The characteristic fossils, Atrypha elongata and Delthyris arenosa, are not found in this rock in the fourth District.
Hydraulic Limestone.	Orthis, Cytherina, Tentaculites,—usually in the upper portions of the mass.
Gypseous marls and shales, or Onondaga Saliferous group.	A thin shelled bivalve has been found in the rock overlying the plaster beds in Genesee county.
Red Shale.	Seen only in the eastern part of Wayne county.
Lockport Limestone.	Catenipora escharoides, C. ——,† Calamopora fibrosa, Cyathophyllum ceratites. Several other coralline fossils are peculiar to this rock. In its eastern prolongation, this rock is characterized by a species of Delthyris and Cytherina.

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* In some places in the 4th District, this rock consists of a few inches of coarse sandstone or conglomerate, between the hydraulic limestone and the Onondaga limestone.

† This is an undescribed species, entirely distinct from C. escharoides, found in the Limestone in Ogden, Monroe county.

Rochester Shale.	Asaphus longicaudatus, Platynotus Boltoni, Homonolotus delphinocephalus, (Trimerus delphinocephalus,) Bumastis Barriensis, Calymene Blumenbachii,* Strophomena depressa, S. elliptica, S. modesta, Delthyris —, Orthis —, Caryocrinus loricatus, C. Ornatus, Gorgonia assimilis.
Limestone.	A large species of Orthis.
2d Green Shale.	Calymene Blumenbachii, C. bufo, Agnostis, Tentaculites, Orthis —, Strophomena —, Graptolites —,
Iron ore.	Fossils similar to those above and below. This mass is mostly wanting in the 4th District.
Pentamerus Limestone.	Pentamerus oblongus, Cateniphora labyrinthica, Favosites, &c.
Iron ore.	Fossils as above and below.
1st Green Shale.	Calymene, Delphinula —, Atrypa —, Strophomena depressa, Gorgonia.
† Medina Sandstone, red marl and shale.	Upper grey portions—Dictuolites Beckii. Below red and variegated—Lingula cornea, Planorbis trilobatus, Cyclostoma pervetusta. Cytherina, Fucoides Harlani, F. ——.

☞ Of specimens illustrating the geology of the 4th District, there have been collected and deposited in the Geological Rooms, at the Capitol, thirty boxes, exclusive of those sent from Cattaraugus county by Mr. Horsford.

JAMES HALL,
State Geologist.

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* It has been remarked that this fossil is found only in the Trenton limestone, and ceased to exist with the deposition of that rock. During the first season of my examinations in the 4th District, I found several fragments of this fossil, and during the last year I have obtained some fine and perfect specimens from the Rochester Shale. The same species, var. major, of Murchison, occurs in the shell grit of Eaton. It occurs also in the Green Shale below the Rochester Shale. See State Cabinet.

† This rock is the lowest in the 4th District, it being found bordering the shore of Lake Ontario, from Niagara river to the eastern limits of Wayne county. The Salmon river group, however, forms the bed of the lake, and in some places is probably at no great distance from the shore, as boulders and pebbles, containing the peculiar fossils of that group, are found on the lake beach in Niagara county and other places, and I have seen the same rocks in place on the north side of the lake, a few miles west of Toronto.

I would beg leave to acknowledge my obligations to the following gentlemen, who have manifested an interest in the progress of the survey, and to whom I am indebted for assistance in various ways: Hon. G. W. Patterson, Jerediah Hosford and Dr. Dwight, of Moscow, to Judge Smith and Mr. McKenzie, of Caledonia, Hon. Elisha Johnson, of Hornby Lodge, Portage, Mr. Rich, Mr. Miller and Mr. Clifford, of Genesee county; also several gentlemen named in the report. I would also acknowledge the polite attentions of Mr. Henry Wyckoff, of Lodi, Seneca county, whose name was omitted in the report of last year.

APPENDIX

TO THE

GEOLOGICAL REPORT OF THE FOURTH DISTRICT.

REPORT

Of E. N. Horsford, to James Hall, on the Geology of Cattaraugus County.

This county is among those of the Fourth District distinguished for their deep and extended valleys, and their ranges of elevated hills. The proportion of irregular surface throughout, but particularly in the southern part, is somewhat greater than it is in either of the counties in the same range, directly east. And, with the exception of the lowlands of the Allegany and Conewango, the amount of level land, compared with the area of the whole county, is in about the same degree less than it is in the other counties.

The valleys of Cattaraugus are remarkable for their uniformity, when viewed as great primeval water-courses, and for the prevalence, in different portions, of particular soils and dependent vegetation.

Their general direction is the same as that of the large valleys farther east,—from north to south. Toward their northern extremes, the beds of most of them expand gradually into plains of considerable width, limited by acclivities of gentle ascent on either side; while some branch into smaller and more irregular valleys. They become, also, more and more shallow, when examination is pursued to the north.

But in their continuation southward, their depth constantly increases, the hills become more and more elevated, and the declivities more and more precipitous. The extreme top of some of the highest points of land can not be less than eight hundred feet above the low grounds of the surrounding valleys.

Along the northern border of the county, there is spread out a body of alluvium totally distinct in character from that prevailing in the southern portions ; and the difference between the two is manifest, as well in the vegetation with which they are clothed, as in the materials of which they are composed. The ravines and gorges of the one have fewer evergreens, and of these the hemlock is the most abundant, while the valleys of the Allegany and its tributaries are distinguished for their forests of pine.

No region of this State, and probably none of any other in the Union, was originally covered with an equal amount of valuable timber. Some of the trees have measured two hundred and thirty feet in height, and five of them have been known to furnish an hundred "lumberman's" logs.* Shingles and boards for the supply of the whole western world, from one extreme of the Union, Louisiana, quite half way to the other, have been manufactured in the shingle shanties and saw-mills upon the Allegany and its tributaries.

The lands of the valleys, and indeed of the entire county, with the exception of now and then limited areas, are susceptible of cultivation. The only swamps worthy of notice are the Conewango and the large one northeast of Waverly. Clay underlies a considerable proportion, and we were informed, the whole of the former. Deep ditchings would reclaim large portions, if not the whole of both, and will without doubt, as the country around becomes more settled, be adopted. Hitherto, the lands having upon them groves of timber, and contiguous to mill-sites, have been more valued for the lumber they furnished, than for the crops they might have been made to produce. The occupation of the lumberman, however, must soon be much less productive than it is at present, and ultimately give way to the duties of the husbandman. When it shall, and when the lands of the valleys enjoy the cultivation given to the flats of the Genesee and Mohawk, there are portions of Cattaraugus that will present fine farms and yield valuable incomes. As grazing lands, they possess attractive features in the constant greenness of the fields, and the abundant supplies of water, that are not to be found in many portions of the country farther north.

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* This item of information was furnished by Mr. Ewing, of Randolph.

ALLUVIUMS.

In the large valleys, and generally throughout the county, the succession of alluvial deposits is clearly defined. Resting immediately upon the rocky floors of the broader and more extended valleys, is a deposit characterized every where by the presence of materials which have been transported from more or less distant northern localities. The proportions of the different ingredients are variable. Toward the Pennsylvania line, the olive sandstone fragments predominate greatly over the pebbles of limestone and primitive rocks from the north. But as the borders of Genesee and Erie counties are approached from the south, the olive sandstone pebbles are less and less frequently met with, until at length they are no longer seen ; and the more northern clays and sands, with the associated gravel, constitute the great bulk of the soil. This variety of soil is usually valued in proportion to the prevalence of these clays and gravel. Where the proportion is large, thirty bushels of spring wheat have been produced from an acre. Where, however, it is small, the attempts to cultivate wheat have uniformly been unsuccessful. At Waverly, Zoar, and at Lime lake, and in the region about each of these localities, the alluvium which contains a large proportion of calcareous and aluminous ingredients from the north, prevails over all the others.

The beds of clay, marl, tufa, bog iron and manganese, and the swamps, are, most of them, in the depressions of this alluvium.

Succeeding this above, throughout the valleys that are traversed by streams, is a yellowish loam, chiefly composed of disintegrated sandstone and shale. It has been washed down from the hill sides and cliffs, by rains and the melting of snows, and emptied into the streams which, in their overflows, spread it out upon the low lands of the valleys. It is the principal soil of the Allegany valley, and of the flats along the Cattaraugus creek. Crops of corn and oats have been usually grown upon this soil. Wheat has also been produced to some extent, but it does not succeed as well as in the alluvium which partakes largely of the northern ingredients.

Upon the highlands is the hardpan, which has been in progress of formation from the earliest emergence of the lands from the ancient sea, down to the last subsidence of waters from the valleys. It differs essentially from either of the alluviums just described. Its materials have been transported but a short distance, and consist of fragments of sandstone in a siliceous clay, of such proportions, and of such texture, as to render cultivation difficult. Rank grass is produced from it, and oats are cultivated pretty well; but wheat can scarcely be grown at all; and such is the elevation, generally, that corn could rarely ripen, if the soil would promote its growth. It caps the hills, and walls the sides of the valleys; and is the cold compact soil which is regarded as the least productive of the alluviums of Cattaraugus.

Clay Beds.

In shallow beds, clay is found more or less in the valleys, but to no extent was it seen upon the higher lands.

That of the Conewango is by far the largest seen. It is observed at Randolph in several places and very possibly underlies a great portion of the immense lowlands and swamps.

It occurs in little "sags" upon the lands of Col. Hawley and Mr. Green in Great Valley. They are of a few square yards in extent, or a few square rods at the utmost; and will, from the small quantity of calcareous matter intermixed, be of value.

It is seen a mile west of Waverly in strata, and alternates with gravel and sand in an alluvial hill directly south of Waverly village.

A swamp on the land of Mr. Sweetland in Little Valley is underlain with it.

It is found about a mile south of New-Albion, an hundred yards from the mouth of a tributary to the stream along which the road passes.

Peat.

In the towns of Great Valley and Little Valley, the "sags" or depressions in which the clay is formed, contain more or less extensive bodies of peat. The largest is upon the land of Mr. Sweetland. About ten acres are spread over by the bog; and the depth of peat varies from a foot or two near the margin, to more than twelve towards the centre. As a manure and as a substitute for coal and wood, this bed in particular, and the smaller ones in proportion to their extent, must become of value. For the improvement of lands, the peat may be appropriated immediately and with great profit on most farms. The discussion of its various uses and the modes of preparation as a manure, may be found in the last year's report of Prof. Emmons.*

The occurrence of peat is generally indicated by the growth of dwarfish evergreens, and rank swamp herbage, and by the elasticity of the crust which supports them.

Marl and Tufa.

These deposits occupy in common with the clay, the superior place in the northern alluvium.

The largest bed by far, yet discovered in the county, is some two miles from Lodi, upon a small branch of the Cattaraugus creek. It lies southeast from the village, and about a quarter of a mile from the mouth of the branch. It has been owned and worked successively by different individuals. A kiln has been erected a number of years, and several thousands of bushels have been burned annually. But recently, great discredit has been brought upon the line of this locality by the too little attention to its burnings: so great as to induce purchasers to prefer going to Buffalo and Dunkirk for the stone lime rather than use it. If burned sufficiently, the tufa and marl limes are every way equal to the best of stone lime, except in solidity. From a safe estimate there are yet remaining 6,986 cubic yards, which, when burned, will furnish 151,590 bushels.

This bed and all others that may hereafter be found, will require careful management to furnish the region looking to the nearest northern point for a supply. There are considerable quantities of the tufa at this bed, in a granular state; which, when it shall be demanded by the scarcity of the compact variety, may perhaps be moulded into bricks by an admixture with the marl of some portions of the bed. Should the marl be found unfit for the purpose from its want of tenacity, the clay from the cliffs of the creek near may be used.

In the east part of Otto, upon the land of Mr. Sias, is a bed of marl that has been worked during the last four or five years. It is spread over between three and four acres, and is from a few inches to four feet deep. About one thousand bushels have been burned annually. With this marl there are no foreign substances, except now and then a little vegetable mould, which all flies away in the process of burning. Estimating the area at three and a half acres, and the average depth at one foot, we have 122,500 bushels, a quantity that will supply the demand, should it increase to three thousand bushels annnally, for forty years to come.

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* Prof. Mather's report, page 216, contains two valuable letters upon this subject.

A small bed of tufa furnished a few kilns with lime in Dutch hollow, in the town of Ashford. It is now nearly exhausted.

A number of small beds have been found near the residence of Mr. Sias, and we were informed that a bed of some extent had been discovered in New Albion.

Near the mouth of the Canaserowlie a bed has been found, and another near Zoar. Neither of them have been worked. Several have been found between the last two localities, but all are small and have not been worked to any extent.

Upon the land of Mr. Hancock, in Freedom, a bed covering a considerable portion of three acres, has been opened. The better portions of it are nearly exhausted, though much yet remains that may be advantageously used for agricultural purposes. From 3,000 to 6,000 bushels have been burned annually for the last twelve years.

Another large one in the north part of Freedom is owned by Mr. Sherman. Its precise extent was not ascertained.

About a mile and a half south of Randolph, a bed of tufa has furnished some lime in years heretofore. It is owned by Mr. Chadwick, of Warren county, Pennsylvania.

Four miles southeast of Randolph, on the land of Judge Leavenworth, a small bed has been found.

Taking the whole together, there are in the county materials of marl and tufa enough to furnish immediately 300,000 bushels of lime. The great proportion of the deposits is, fortunately for the future interests, in the north part of the county. The Genesee Valley canal will supply the depots of Olean and Hinsdale with the Caledonia limestone; and the New-York and Erie rail-road, and the Allegany river, when the former shall be constructed and the latter made navigable by the removal of obstructions, will supply the southern part of the county, from one extreme to the other.

Bog Iron Ore.

Beds of this variety of iron ore are found in many little swamps and lowlands in different parts of the county. Across the river from Olean, masses containing several cubic feet have been excavated. The percentage is, generally, so low that the working of it can never be profitable until iron shall have increased greatly in value.

Manganese.

The black oxide is found in small granules in different parts of the Conewango and Little valleys. More was seen upon the land of Mr. Bush, in Randolph, than in any other place. It is accumulated in nodules, in some places, from the size of a shot, up to that of a walnut. In other places, it is seen adhering to fragments of sandstone, scattered throughout the soil. It has not yet been found in quantities sufficient to be of value.

Mr. Earll, of Napoli, has, within the last few years, found two pieces of metallic matter, which, he says, were upon analyses, by a German chemist of Buffalo, found to contain seventy-five parts of tin, and twenty-five of bismuth. They were found in a path leading to a spring, about a mile and a half north of Bushnell's tavern. One of them was quite rectangular; the other had the appearance of having been melted and dropped into the soil in its molten state. Much interest, for a time, was felt in these indications, as they were supposed to be, of a rich store, at no great distance from the locality where the two pieces were discovered. It has been remarked by Prof. Vanuxem, that they were probably dropped there by Indians, who obtained them from the French, when the latter nation had possession of the Canadas.

Near Lodi, nodules of iron pyrites are found in considerable quantities, in the upper portions of the gravel alluvium, underlying the loam of the valley. From these, a Mr. Smith claims to have wrought certain metallic bars, which are believed by many of the inhabitants in the vicinity, to be of silver. A small piece of one of them, together with a parcel of the ore, was furnished to the State by Nicholas Devereux, Esq. This piece has the general appearances of pretty pure malleable iron.

Instances of this species of self-deception are of frequent occurrence, and show very forcibly the necessity of extending, as far as may be, the aids of science. A slight acquaintance, even, with the origin of the

Cattaraugus alluviums, would uproot every expectation of finding mineral wealth in the soil. It might be quite possible to find a single piece of silver ore, as there have been found masses of primitive iron in such position ; but when it is known that the metals are by far the smallest component parts of the earth's crust, and that most soils are fragments of this crust, gathered together by currents from widely separated localities, it will be no longer expected that, because a single piece of a precious ore is fallen upon, there are therefore indications that large bodies of ore, freed from admixture with foreign material, will be found in the same associations ; or that even another piece may be procured at the same locality. And above all, it will be deemed the height of folly, to waste treasures in mere search, with no evidence of the near existence of the object looked for.

Boulders.

Of these there are more profuse distributions on the Cattaraugus, near Lodi, and in the course of the alluvium southward than any where else in the county. Trappæan, hornblendic, gneissiod, granitic and sienitic, and some others, are the representatives from more northern latitudes. One boulder of hypersthene was seen at the sulphur springs near Randolph.

Two boulders of iron, resembling the compact, fine grained, primitive ore, of the veins of McIntyre iron in the Adirondack lands, were found on the south branch of the Cattaraugus, near Little's mills. One weighs thirteen pounds. Both have been procured for the State collection.

SPRINGS.

Springs of *Saline* impregnation are occasionally found. Several near Rutledge attracted attention in the early settlement of the town, from the numbers of deer who came to "*lick*" about them. Near one of these a shaft was sunk, in the hope that lower down the strength of the solution would be found greater. The proportion of salt was, we are informed, about a teaspoon full to a pail of water.

The *Oil spring* of Freedom, is in many respects like that of Cuba, in Allegany county. Its diameter is somewhat less, and the quantity of oil which in a given time rises to the surface is in proportion to its extent the same. But the association almost directly above of a sandstone, more highly bituminous than any other rock in the district, gives it an attraction which is not possessed by the Cuba spring. Between the lower outcropping of this sandstone and the spring there are about twenty-five feet of bluish aluminous shales, of the same character as those on the Cattaraugus creek, above Zoar. Excavations in several places about the spring have been made, in the hope of finding coal, which have revealed the rocks in the vicinity, and furnished some evidence concerning the origin of the petroleum. In one of the holes, about a dozen yards from the spring, after digging fourteen feet, a thin hard stratum was struck upon, too firm to yield to the pick-axe and spade, which had been the only instruments used in throwing out the softer shale. A bar was then obtained, and the hard layer perforated. The instant the hole was forced through, the pure, glossy, black petroleum, mingled with water, gushed up with great violence. In a short time the whole excavation was filled, and such was the quantity of pure oil upon the surface, that several gallons were carried away daily for a considerable time.* After this event, the issuing of oil at the old spring was lessened, and in process of time the passage to the source of the oil in the excavated spring became obstructed; so that now the whole quantity is less than it was in the early settlement of the country.

Carburetted hydrogen is emitted at this spring in small quantities. It is observed to escape from almost all waters, either stagnant or running, in the county. It is seen bubbling up through the waters of most large springs. The only place where the quantity is sufficient to maintain a constant flame, is at the mouth of a small stream coming in to the Cattaraugus, against the missionary house, about five miles above La Grange.

Sulphur springs are occasionally met with. One upon the land of Judge Leavenworth, near Randolph, is pretty strongly charged.

Several have been noticed issuing from the Cashaqua shales, at the bases of the cliffs upon the Cattaraugus creek and the South branch.

ROCKS.

There is an obvious thinning out to the west, of some of the groups which were last year established in the section along the dividing line between the third and fourth districts. And there is also an equally obvious increase in thickness of some others of the groups. The thinning out, however, prevails over the expansion, so that the whole body of rocks in Cattaraugus, above the Moscow Shales, and below the conglomerate, is much less than it is as far east as Painted Post.

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* We are indebted to Mr. Roselle, the proprietor of the lands, for personal attentions, and the above information.

The shales observable between Ithaca and the termination of the black shales a few miles down the Cayuga lake, are developed farther west, and particularly along the Cattaraugus creek, upon a grand scale. While the Ithaca group, immediately succeeding, is almost entirely wanting.

Of the groups above, only the most imperfect sections were seen, but all the geological features of the county taken together, clearly indicate a reduction in their thickness.

Beside these groups, there are two which deserve particular mention in a notice of the rocks of this county: the Ischua Sandstones and the Conglomerate.

The *Ischua Sandstones*, of which a description is given under the head of *quarries*, are developed in Allegany county in a few localities. Numbers of large rectangular masses are found in the valley of Wigwam creek, which point to the ledge somewhere in the vicinity, though perhaps buried below the soil. In place, they were seen in the bed of a small stream emptying into Black creek from the west, about ten miles from Angelica. Its farther extension west, than the region of Machias, has not been ascertained.

The *Conglomerate* is the highest rock in the series that has yet been observed in the State. Immense blocks of it are found at Chipmuck ripple, on the Allegany river, and near Judge Wright's, southeast of Ellicottville. Also between Napoli and Little valley, on the Jamestown and Ellicottville stage road, near Judge Leavenworth's, and at numbers of other localities. But the places where it is seen in ledges are comparatively few, and only upon the very highest points of land. One, south of Olean five miles; two between Great valley and Little valley, and several south of the Allegany, comprise all in this county concerning which information was obtained.

The locality most visited, is about seven miles south of Ellicottville, and one and a half west of Great valley post office. It is known as the *Rock city*. It is approached along a ridge extending from the base to the top of the hill, of gradual ascent, and terminating at an elevation of not less than six hundred feet. Other hills, upon the opposite side of the valley, and of less altitude, were determined by Col. Hawley to be above six hundred feet in height.

The suburbs of the city extend for a distance of fifty rods, at least, beyond the more densely congregated masses of rock. Passing through them, we come among masses more and more nearly associated, until at length we reach the continuous ledge. In the midst of the huge blocks, one in particular, from its shelving over all around, has attracted attention. Its base is narrow, and its height, upon the lower side, nearly twenty feet. From this, every where around, are blocks of the conglomerate, varying from fifteen to thirty-five feet in height. Most of them are rectangular. Some have been so slightly separated as to leave a space between of but a few inches. Others have been thrown asunder several yards. The disintegration and removal of large masses in the midst of groups, have spread out fine court-yards. More than an hundred acres, it has been reported, are covered by these fragments, at this single locality. The plat occupied by the immediate breaking up of the strata, is much less, though an area sufficiently large to embrace all the masses that have successively slipped down the declivities, may be even much larger. The whole scene of the outcrop is in the highest degree imposing, and impresses upon the beholder the conviction that the name has not been unfitly chosen.

The principal features of interest, separate from the general forms and arrangement of the masses are the irregularity in stratification, the distribution of iron ore, and the component parts of the rock.

Near the bottom of most of the masses, the stratification is regular; but the upper portions are more generally irregular. Between the regular and irregular the line is very distinctly drawn, both above and below. The inclination of some of the irregular strata was more than thirty degrees.

Iron seams, varying more than an inch in thickness, are to be seen in many of the blocks. They are of no constant direction. In some portions they are parallel to the plane of the horizontal strata, and in others inclined as many as fifteen degrees. Here curved so as nearly to complete a cylinder, and there vertical. They are altogether distinct from the general deposition. In some of them there is an admixture of the black oxide of manganese.

The rock is principally composed of white and yellowish quartz pebbles and sand. The former vary in size, from a large grain of sand to that of a hen's egg. One measured three inches in length. The thickness of the whole strata is variable. South of Olean, it is generally less than twenty feet, while at Rock City near Great Valley, some blocks are thirty-five, and at Merritt's mills upon the Allegany, ten miles below the State line, the cliff is more than one hundred and fifty feet in height.

QUARRIES.

From the abundance of timber in Cattaraugus, little need of good building stone has hitherto been felt, and, consequently, little exploration has been made for valuable quarries. Of those opened in different parts of the county, nearly every one will be found noticed in the list which follows.

The quarries against Olean, contain micaceous sandstone, and an olive shale, which is concretionary. The stone at the lower quarry are coarse, while at the one some fifty feet above, they are of a finer grain. The underpinnings and cellar walls of many buildings in Olean, have been obtained from them.

A quarry owned by Mr. Pratt, in a small alluvial hill, an hundred rods down the river, from the quarries above noticed, is nearly exhausted.

In a ravine which is entered just south of Pratt's quarry, there are found masses of a coarse sandstone, like that alternating with the conglomerate which is seen a few miles south. These masses are strewn along the ravine its entire length. In the hope of finding the rock in place, an expedition, in company with several gentlemen of the town,* was made to the summit of the mountain. All the way from the base, in following Pratt's ravine, to within a dozen yards of the very highest point, masses of the rock, coarse grained, micaceous and characterized by vertical fucoides, varying in magnitude from blocks of a cubic foot to those of several cubic yards, were found indiscriminately scattered about. So angular were they, so frequent, and so wholly above the earth, that it seemed as if the ledge could be, at the most, but a few yards distant, at every place a stop was made. At the termination, there are no appearances that indicate the occurrence of a ledge; such as projection above and abruptness below, or large rectangular masses lying near each other, with matched edges. But on the contrary, their surfaces, their roughness, their association and position display nothing more striking at the highest point, than the groups a few yards from the base of the hill. Upon the highest point none were found; and it may be accounted for satisfactorily, upon the supposition that the fragments in question were component parts of one of the lower layers of the coarse sandstone and conglomerate, whose outcrop, a little farther south, has already been mentioned. If this occupied the plot terminating the ascent, it may all, in the agency of the great bodies of water which once lashed even the highest cliffs, have been easily wafted from the summit and distributed down the sides.

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* Messrs. McMartin, Penfield, Richardson and others.

The same rock occurs in several places along the Allegany, in huge fragments, and is seen to be of the most durable character, from the unchanged angularity of the masses, notwitstanding their long exposure to the action of the current.

From examinations made in Pennsylvania, its true place is ascertained to be in the lower part of the conglomerate. Could it be obtained south of Olean, without too much excavation, its value as a material for public works, would bring it immediately into demand.

Nine miles below Olean, sandstone, slightly concretionary, has been quarried for the filling up of dams and other purposes.

The *Ischua stone quarries*, lying almost wholly in the town of Machias, contain stone with which there are none other in the county to be compared, either for beauty when dressed, for readiness in getting out, or for durability. They are a coarse sandstone, disposed in massive, and in thin layers, of such thickness, that blocks for every desirable purpose, from heavy columns to thin flagging stone, may be procured with facility. There are, indeed, no stone, except some of the limestones north, in all western New-York, that equal them.

Butler's quarries, three miles north of Franklinville, have been most extensively worked. The foundation walls of Irvine Hall, Ellicottville, were here procured. The quarries are in the visible outcrop, which extends for a considerable distance, with a gentle ascent behind, scarcely more than two degrees, and an abrupt descent of a few feet immediately before. The earth above, will never be a serious hindrance to excavation, when the more accessible portions shall have been exhausted. In the supposition that the area of the quarry which may be worked is but five acres, and that its average depth is but nine feet, there are 14,520 cubic yards. Hitherto the dressed stone have been little used; the want of some channel of communication with distant markets having prevented extensive sales.

Talbot's quarries are a half mile south from Butler's, and have been opened some time. They are in the same strata.

Fisher's and Brace's, have furnished some. At Brace's the ledge has not been searched for, there being an abundance of fragments of requisite sizes.

In all this sandstone, of a greyish and sometimes of an olive colour, there is a difference observed in the ease with which they can be dressed. It was thought to be owing to the relative coarseness of the grains of sand.

If there could be established means of communication with the Genesee Valley canal, the stone of these quarries might be distributed through the southern tier of counties along the New-York and Erie rail-road, as well as along the canal, and eventually Pennsylvania markets might be supplied.

Hancock's quarries about five miles northeast from Machias Corners, in Freedom, are of finer grain and micaceous. Grindstones are manufactured by Mr. Hancock, from them, which are said to be of an excellent quality.

Roselle's quarries, in Freedom, are in the same strata. These stone are the most strongly impregnated with bituminous matter, of any seen in the district. Near Roselle's quarries, is the oil spring already described.

Mc Clure's quarries, one mile west of Franklinville, furnish a fine grained bluish sandstone.

Half a mile west of Cadiz, a quarry has furnished a few cubic yards, of an olive and greyish sandstone. The layers are thin, but in all five feet thick, with a thinner layer of fossils, separating each two of the strata. A heavy deposit of shale overlies the whole.

Stone have been procured four miles east of Ellicottville, but the earth from above has slipped down and filled up the quarries.

Gregory's quarry, at the base of the hill rising west of Ellicottville, on the road to Randolph, has been long opened, and has furnished most of the stone used in the village. There are some five or six feet of building and fire-stone.

In the ravine a little farther west, a new quarry has been opened.

A half mile south of Col. Hawley's in Great Valley, a cliff has been blasted off for several yards, but the stone were not found to be valuable.

On the road leading to Ashford, from Ellicottville, a mile and a half from the last named town, is a section of sandstone about twelve feet high. They are of the commonly quarried variety, olive and greyish.

South of New-Albion, half a mile, are several quarries owned by Mr. Graham. The stone are of the same variety as the last; some layers are slightly concretionary.

Van Sickle's quarry was formerly worked in Little Valley, but the earth from above has buried it. Judge Leavenworth's residence was erected from stone procured there.

Nutting's quarry in Napoli, and Woodford's in Randolph, have furnished many stone for underpinning.

Davenport's in Conewango, and several in the vicinity of Rutledge, furnish the same thin olive grey sandstone, that is principally found throughout the middle and southern portions of the county.

A mile south of Randolph, quarries of the same kind of stone have been opened.

Two miles south of Leon Centre, upon Bailey's land, building stone have been quarried to a considerable extent. The sandstone are inclining to coarse grained, and are the next in value to the Ischua stone. Others have been opened near Leon village.

A mile and a half north of Leon Centre, a quarry in olive sandstone has been opened. A single layer only has been worked.

Of specimens for the State collection, there were sent from Cattaraugus, eight boxes.

We are indebted for personal attentions and acts of kindness, to Messrs. Ewing & Leavenworth, of Randolph, and Col. Hawley, of Great Valley.

Respectfully submitted,
E. N. HORSFORD.
Assistant Geologist,
Fourth District, N. Y.

GLOSSARY OF TECHNICAL TERMS.

Alluvium. A recent deposit of earth, sand, gravel, peat, &c.; the term is applied to depositions which are now accumulating, as at the mouths of rivers, &c.

Alum rocks. Rocks which, by decomposition, form alum.

Amorphous. Bodies devoid of a regular form.

Amygdaloid. A rock more or less cellular in its structure, and at the same time abounding in cavities in the shape of an almond. It is one of the class usually called Trap rocks.

Anticlinal axis, ridge, &c. The line from which the strata of any formation dip in two directions, like the roof of a house.

Augite. A simple mineral of variable colours, passing from white through gray, green and black of different shades. It is a constituent of many volcanic and trappean rocks, limestone, granite, &c.

Basalt. A black or grayish black compact rock occuring frequently in a columnar form, as at the Giant's Causeway in Ireland. Many geologists consider it to have been formed by the fusion of augitic and feldspathic rocks under great pressure, as at the bottom of an ocean or deep sea; hence its compact structure.

Basin. Deposits lying in a hollow or trough-shaped excavation, are said to occupy basins.

Bed. A mass of mineral matter lying between the layers or strata of any rock.

Bitumen, bituminous, &c. An inflammable substance which presents itself under two forms, a solid and liquid; when in the former state, it is called *asphaltum.* In its liquid state it is like tar. Seneca oil is an example of it. Coals, slates, limestones are often bituminous.

Blende. A German name for sulphuret of zinc.

Boulders. Rocks which have been transported some distance from their original beds; they are more or less rounded by attrition and the action of the weather.

Botryoidal. Resembling in form a bunch of grapes.

Breccia. A rock or portion of a rock composed of angular fragments, cemented together by lime, iron, or some other substance.

Calcareous spar is crystallized carbonate of lime.

Calc sinter. A deposition of porous carbonate of lime, from the waters of mineral springs.

Carbon. A simple substance, known in a pure state in the diamond only. It is one of the combustible elements in coal.

Calciferous. Bearing or containing lime.

Carbonates. Compounds formed by the union of carbonic acid and a base.

Carbonic acid. An acid gaseous compound composed of carbon and oxygen. It is incapable of supporting combustion, and deleterious to animal life. It is heavier than atmospheric air; and hence is found at the bottom of wells, cisterns or caves. Its presence may always be known by letting down a candle, by which it will be extinguished; a precaution which should always be observed previous to descending into them. A person is rendered entirely incapable of exerting himself the moment he inhales this substance, and of course cannot extricate himself when immersed in it.

Carboniferous. Coal-bearing.

Chloride. A combination of chlorine and a base, as sodium, which, in chemical language, is called a *chloride of sodium;* in common language, it is dry sea salt.

Chert. A silicious mineral resembling flint, hornstone, &c. Rocks containing it, are called *cherty.*

Chlorite. A soft greenish mineral composed of minute scales closely compacted together. It differs very little from soapstone. Rocks containing it, are said to be *chloritic.*

Clinkstone. A rock allied to basalt, which rings when struck.

Cleavage, is the separation of the lamina of rocks or simple minerals in certain constant directions. In rocks, it is not always parallel to the planes of stratification; and hence the planes of cleavage may be mistaken for those of stratification, and vice versa.

Coal measures, coal formation. Rocks containg coal.

Conformable. The arrangement of the strata of two rocks in parallel position.

Conglomerate. Masses of rounded stone, gravel and dirt, cemented together.

Cretaceous. Belonging to the chalk formation.

Crop out, and *out crop.* Emergence of a stratum or a rock from the soil, or from the adjacent strata or rocks; in other words, its appearance at the surface.

Crystal, crystalline. A geometrical solid; the latter, an assemblage of imperfectly defined crystals.

Crustacea. Animals having a thin coating or crust, like the lobster, which they shed periodically.

Delta. Alluvial lands formed near the mouths of rivers, of a triangular shape, and included between the branches of the river and the seashore. Large rivers, just before their entrance into the sea, frequently divide into several branches; this division is in consequence of the earthy matter borne down by the river to its junction with tide water, where it is deposited, forming thereby banks of sediment which rise in time above the water.

Denudation. A term used to express the removal of sedimentary matter from any area. Rocks from which any covering has been swept off by currents of water, are said to be denuded. Valleys are sometimes formed in this way; they are then called *valleys of denudation.*

Deoxidized. Deprived of oxygen.

Dicotyledonous. One of the grand divisions of the vegetable kingdom, founded on the form and structure of the seed, which, as the name expresses, has two seed lobes.

Diluvium. An accumulation of loose sand and gravel, and other materials, which some geologists suppose to have been collected or spread over a district by the action of a deluge.

Dip. The angle which a stratum or series of strata make with the plane of the horizon. The *direction of dip*, is the point of compass towards which the strata sink or plunge, and the *angle of dip* is the amount in degrees which the planes of the strata make with the plane of the horizon.

Dislocation. A lateral or vertical displacement of a vein, stratum or series of strata, destroying thereby the coincidence of the planes of stratification in the same formation, and breaking the continuity of veins, dykes, &c.

Dolerite, one of the trap rocks, composed of feldspar and augite.

Dolomite, a magnesian carbonate of lime.

Drift, a horizontal passage into a mine.

Dunes or downs. Sand raised into hills and drifts by the wind.

Dykes or dikes. Veins of stony or rocky matter, belonging to the unstratified class, as granite, greenstone, lava, &c. which intersects the strata or cut through them, and generally approaching to verticality. It is a Scottish term for *wall*, as the dyke often projects upward above the strata in the form of a wall. The materials forming a dyke, are supposed to have been injected in a melted state from beneath, into cracks and fissures which have been formed by the drying of the earth's surface, or by convulsions of a more powerful kind, as earthquakes.

Earth's crust. The superficial parts of the earth's surface, which are accessible to observation.

Eocene. An era or period which commenced with the present order of things, applied with particular reference to the animate creation; it signifies *dawn.*

Estuary. An inlet of the sea towards the land. The extent is confined to the limits of salt water, or the area in which fresh and salt water mingle.

Exuviæ. Fossil remains of animals.

Fault. Displacement of veins, dykes and strata commencing first in their fracture and ending in their removal in some direction by which the continuity of their planes is destroyed. See *Dislocation.*

Feldspar, one of the simple minerals, and next to quartz one of the most abundant.

Feldspathic, of or belonging to feldspar.

Ferruginous, containing iron.

Fulviatile, belonging to a river.

Formation. Deposits having a common origin, or formed during the same era or period.

Fossils. Remains of plants and animals buried in the earth.

Fossiliferous. One of the grand divisions of rocks characterized by the presence of fossils.

Galena. Sulphuret of lead, or sulphur and lead; one of the common ores of lead.

Gangue. The earthy or rocky material which embraces directly the metalliferous compounds in any vein.

Garnet. A hard reddish or brownish mineral usually crystallized in the form of a solid having twelve rhombic or diamond shaped faces or planes.

Geology. A science which has for its object the investigation of the structure of the earth and the materials of which it is composed. Connected with these investigations, are deductions which may be derived legitimately from the known influences and effects of causes; these are employed as expressions of the modus operandi by which the earth has deen brought to its present state.

Gneiss. A stratified primary rock, composed of quartz, feldspar and mica.

Granite. An unstratified rock, composed of quartz, feldspar and mica.

Grauwacke, *graywacke.* The name was originally applied to a rock composed of grains and pebbles cemented together by clay. It belongs to the transition series. The name is applied also to a group of rocks in the same series, consisting of sandstone, slates or shales, alternating with limestone, sandstone, &c. The term is rather indefinite, yet very frequently used.

Green sand. Beds of sand, sandstone, limestone and marly clays, intermixed somewhat with greenish particles, belonging to the cretaceous period, and situated beneath the true chalk.

Greenstone. A variety of trap, composed of feldspar and hornblende.

Grit. Coarse grained sandstone.

Gypsum. A mineral composed of sulphuric acid and lime.

Hornblende. A mineral, usually of a dark green colour; crystallizing in long slender prisms.

Hornstone. A silicious translucent mineral, resembling flint, but tough and more difficult to break.

Incandescent. White hot—a degree of heat more intense than that at redness.

Iceberg. Floating masses of ice.

Ichthyosaurus. A fossil reptile, intermediate between the crocodile and fish. A fish lizard.

Induction. A consequence, conclusion or inference, or some general principle drawn from facts or phenomena.

Io-situ. Original position.

Isothermal. Equality of temperature. Zones, lines, &c. where an equality of temperature prevails are called *isothermal.*

Lacustrine, of or belonging to a lake.

Laminæ. Plates, sometimes used as synonymous with layers.

Landslip. Land which has slidden down an inclined plane, from its position in a bank or terrace. It is generally produced by water, which either undermines the mass of earth, or insinuates itself into it, so as to render it semi-fluid.

Line of bearing. The point of compass to which the anticlinal ridge or line runs, or is directed. When the antiangle ridge cannot be determined, the *line of direction* may be known by ascertaining the intersection of the planes of the strata with the plane of the horizon, that will be the line of bearing.

Lithological. The character of a rock or formation considered with reference solely to its mineral composition.

Lignite. Wood partially carbonized in the earth; it usually retains the vegetable structure. The change does not seem to have been effected by heat, but is the result of some chemical process, as the action of pure sulphuric acid in some instances, and of water in others.

Littoral, of, or belonging to, the shore.

Loam. A mixture of sand and clay.

Mural Escarpment. A rocky cliff, more or less inclined.

Mammillary. Protuberances on the surface of a mineral, which are segments of sphere; mammæ, breasts.

Mammoth. An extinct species of animal, allied to the elephant.

Marl. Any mixture of clay and carbonate of lime, which effervesces with acids.

Matrix. Gangue. The mineral mass which is in immediate contract with the ore of a metal, both of which constitute a vein.

Manganese. A hard black mineral, resembling the dark coloured hematites. It is the oxide of manganesium, one of the metals.

Megatherium. One of the extinct fossil quadrupeds, resembling the sloth.

Mechanical origin of, Rocks composed of sand, pebbles, &c. or sedimentary rocks generally, are said to have a mechanical origin. The term is used in contradistinction to rocks having a crystalline structure, which have a chemical origin.

Mica. Sometimes called isinglass. A mineral, which may be split into numerous elastic laminæ.

Mica slate. A primary rock, composed of fine grains of quartz, and generally small scales of mica. It is eminently fissile.

Miocene. An era or period subsequent to the eocene, and characterized by a greater proportion of animals analogous to those now living. Deposits formed during this period are termed miocene strata.

Molusca. Moluscous animals. Those soft animals, whose covering is a thick shell, as oyster and clam.

Monocotyledonous. One of the grand divisions of the vegetable kingdom. It includes the grasses, palms, liliaceæ, and whose seed have only one lobe.

Mountain limestone. A series of limestone strata immediately below the coal measures.

Muriate of Soda. The chemical name for common salt, because it is composed of muriatic acid and soda.

Naphtha. A very thin volatile inflammable liquid, of which there are springs in some volcanic districts.

New Red Sandstone. A series of sandy, argillaceous, and often calcareous strata, whose predominant colour is brick red, but contains many spots and stripes, which are gray and greenish gray. It is therefore sometimes called the variegated sandstone. It overlies the coal measures.

Nucleus. A solid central piece, around which layers of the same or other matter has collected. The kernel.

Old Red Sandstone. A rock belonging to the carboniferous group.

Oolite. Oolitic. A limestone composed of rounded grains, like the roe or eggs of fish. The name is applied to a large group of strata, characterized by peculiar fossils. Only a part have this peculiar structure.

Orthocera, orthoceratite. An extinct genus of animals belonging to the order Molusca. They inhabited long strait tapering shells, divided into parts by septa or partitions. Common in the transition or Trenton Falls limestone.

Outcrop. The edges of strata, as they appear at the surface.

Outliers. The detachment of a mass of rock from the general formation to which it belongs; or it is a term applied to a mass which appears as if it was detached from the general formation, as its outcrop is at a distance from it.

Oxide. The combination of a metal, or any substance with oxygen, which is not acid.

Oxygen. One of the constituent elements of the air and water; that portion of the air which supports life and combustion.

Pachydermata. An order of animals with thick skins, as the hog, elephant, rhinoceros, mammoth, &c.

Palæontology. The science which treats of fossil remains, both animal and vegetable.

Pelagian. Belonging to a deep sea.

Petroleum. Mineral pitch; a liquid approaching the consistence of tar, of a bituminous odor, and which oozes out of a rock.

Phlegræan fields. The burnt fields; applied by the Greeks to the region around Naples, from the marks of igneous action every where visible.

Pisolite. A stone composed of rounded particles like peas, agglutinated together.

Pliocene. An era or period analogous to the present, and more recent than the *miocene.* A large proportion of the animal remains of the *pliocene* strata still exist.

Porphyry. A rock having a base whose structure is more or less compact, in which there are disseminated crystals of feldspar.

Productus. A bivalve fossil shell, concave on one side, and convex on the other.

Plastic clay. One of the beds of the eocene tertiary period.

Plesiosaurus. A fossil extinct reptile, having a close resemblance to a lizard.

Precipitate. The fine powder which separates from solutions after standing, or which are disengaged by the chemical action of bodies added to those solutions.

Pumice. A light spongy lava.

Puddingstone. Indurated or cemented masses of rounded pebbles, sand, &c.

Pyrites. A mineral composed of sulphur and iron, or sulphur and copper.

Quartz. The term universally applied to a simple mineral, composed of nearly pure silex. Rock crystal is an example.

Rock. A term applied to all mineral beds or masses.

Sandstone. A rock composed of grains of sand.

Saurians. Animals belonging to the tribe of lizards.

Sacchoroidal. Resembling loaf sugar.

Schist, schistose. Slate and slaty.

Septaria. Flattened balls of stone traversed by seams of calcareous spar or some other mineral. The outer surface has the appearance of a turtle's back; and hence they have been considered, by persons of little observation, as petrified turtles.

Shale. Generally used as synonimous with slate.

Shell Marl. The name is applied to recent fresh-water deposits, which consist of marl and numerous shells of Helices, Planorbis, &c. intermixed.

Shingle. Beaches and shores covered with waterworn pebbles and gravel.

Silex. One of the simple earths, nearly pure in rock crystal.

Silt. The finer particles of the earths suspended and transported by water.

Simple, when applied to minerals and rocks, has reference to their homogeneousness, and not to the number of elements which enter into their composition.

Stalactite. A pendant cylindrical mass of carbonate of lime, attached to the roof of a cave.

Stalagmite, is a mass of concreted limestone formed beneath the stalactite, by water dropping from it charged with carbonate of lime.

Stratum, strata, stratification. The arrangement of the layers of a rock in parallel position.

Strike. The direction in which the edge of a stratum appears at the surface.

Syenite, sienite. A variety of granite in which hornblende replaces the mica.

Synclinal line or axis. Where the strata dip downwards like the sides of a gutter.

Talus. A collection of rocks and stones beneath a cliff.

Tertiary. The fourth grand division of the rocky strata, composed of clays, gravels, and sometimes of consolidated beds of limestone and silicious matter; all of which are more recent than those of the three preceding divisions, as primary, transition and secondary.

Testacea. Moluscous animals having a shelly covering.

Tepid. Warm.

Thermal. Hot.

Thin out. The diminution in the thickness of strata, until they disappear.

Trap, trappean rocks. Ancient volcanic rocks composed of feldspar, hornblende, and hornblende and augite. Basalt, greenstone, amygdaloid and dolerite, are the most common of this class of rocks. They are sometimes called *superincumbent rocks,* because they rest or repose irregularly or indifferently on any of the other rocks. The pure hornblende rocks were formerly termed *primitive trap.*

Travertin. A deposit of carbonate of lime, more or less porous and earthy, from the water of springs; sometimes it is hard and semicrystalline.

Tufa, calcareous and silicious. Porous or earthy deposits from springs of water, containing lime or silex.

Tuff or *Tufa, Italian.* A name for a volcanic rock of an earthy texture.

Unconformable. See *Conformable.*

Veins. Openings or fissures in rocks, filled with stony or metallic matter.

Zoophites. Animals of the lowest order, as sponges, corals, &c.

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